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Forest Service

Tongass
National Forest

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Sea Level Timber Sale

Final Environmental Impact Statement

Volume I



Acronyms

ADF&G	Alaska Department of Fish and Game	RM	Roaded Modified
AFHA	Aquatic Fish Habitat Assessment	RMA	Riparian Management Area
AFRPA	Alaska Forest Resources and Practices Act	RN	Roaded Natural
AHMU	Aquatic Habitat Management Unit	ROD	Record of Decision
ANCSA	Alaska Native Claims Settlement Act	ROS	Recreation Opportunity Spectrum
ANILCA	Alaska National Interest Lands Conservation Act	SHPO	State Historic Preservation Officer
ASQ	Allowable Sale Quantity	SIS	Silvicultural Information System
BBF	One Billion Board Feet	SPM	Semi-Primitive Motorized
BLM	Bureau of Land Management	SPNM	Semi-Primitive Nonmotorized
BMP	Best Management Practice	SRI	Sediment Risk Index
CEQ	Council on Environmental Quality	TPIT	Tongass Plan Implementation Team
CFI	Continuous Forest Inventory	TLMP	Tongass Land Management Plan
CFL	Commercial Forest Land	TRUCS	Tongass Resource Use Cooperative Survey
CFR	Code of Federal Regulations	TTRA	Tongass Timber Reform Act
CZMA	Coastal Zone Management Act of 1976	USDA	United States Department of Agriculture
DBH	Diameter at Breast Height	USDI	United States Department of the Interior
EIS	Environmental Impact Statement	USFWS	United States Fish and Wildlife Service
EPA	Environmental Protection Agency	VCU	Value Comparison Unit
EVC	Existing/Expected Visual Condition	VQO	Visual Quality Objective
FSH	Forest Service Handbook	WAA	Wildlife Analysis Area
FSL	Forest Science Lab		
FSM	Forest Service Manual		
GIS	Geographic Information System		
IDT	Interdisciplinary Team		
IMEG	Interagency Monitoring and Evaluation Group		
ITS	Individual-Tree Selection		
KPC	Ketchikan Pulp Company		
KV	Knutsen-Vandenberg Act		
LSTA	Logging System Transportation Analysis		
LTF	Log-Transfer Facility		
LUD	Land-Use Designation		
LWD	Large Woody Debris		
MBF	One Thousand Board Feet		
MIS	Management Indicator Species		
MM	Maximum Modification		
MMBF	One Million Board Feet		
MMI	Mass-Movement Index		
NEPA	National Environmental Policy Act		
NFMA	National Forest Management Act		
NMFS	National Marine Fisheries Service		
NOI	Notice of Intent		
NPDES	National Pollution Discharge Elimination System		
P	Primitive		
PR	Partial Retention		
R	Retention		

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Front cover: By Cindy Ross Barber, 1992. The design illustrates the range of interconnected issues addressed in the EIS.

Final Environmental Impact Statement

Sea Level Timber Sale

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Forest Service—Alaska Region

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Abstract

The USDA Forest Service proposes to harvest approximately 60 million board feet of timber in the Sea Level Project Area, Ketchikan Ranger District, Tongass National Forest, under guidance of the Tongass Land Management Plan of 1997 (TLMP). The Proposed Action analyzed in this Environmental Impact Statement (EIS) is designed to implement direction contained in the TLMP. The purpose and need for this Project is to implement TLMP direction. This direction is consistent with providing for the multiple use and sustained yield of forest resources and includes: (1) to help provide a sustained level of timber supply to meet annual and TLMP planning cycle market demand, (2) to provide local employment in the woods products industry. Another objective is to provide timber volume that will contribute to the timber supply under the Tongass National Forest timber-sale program. This EIS describes three action alternatives which provide different combinations of resource outputs and locations of harvest units. There is one no-action alternative. Alternative 1 (the No-Action Alternative) proposes no new harvest from the Project Area at this time. Alternative 2 proposes harvest units which provide the maximum amount of timber within TLMP standards and guidelines. Alternative 5 proposes to meet the purpose and need while avoiding timber harvest in the Minx Flats, Elf Point, and Marble Creek areas in order to address wildlife-habitat connectivity concerns. Alternative 7 configures harvest units to emphasize timber economics by harvesting stands with the greatest potential for economic return, while minimizing impacts to old-growth habitat and wildlife travel corridors. The location of harvest units, selection of silvicultural prescriptions, logging systems, and a transportation network is designed to maximize the appraised timber value.

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Volume I

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Chapter 1

Purpose and Need

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Chapter 1

Purpose and Need

Key Terms

Allowable Sale Quantity (ASQ)—the maximum quantity of timber that may be sold each decade from a National Forest.

Land-Use Designation (LUD)—method of classifying land uses, presented in the Tongass Land Management Plan of 1997.

MMBF—million board feet.

Management Prescriptions—the intensity and schedule of management practices on a specific area to attain multiple-use goals and objectives.

Old-growth Forest—an ecosystem distinguished by old trees and related structural attributes. They differ from younger forests in a variety of ways, including tree size, accumulation of large, dead woody material, number of canopy layers, tree species composition, and ecosystem function.

Scoping—a process used to determine: the significance of a proposed action, what analysis is required, what data is needed, and what public participation is appropriate.

Tongass Land Management Plan (TLMP)—the 10-year land-allocation plan for the Tongass National Forest, also known as the Forest Plan. The TLMP was revised in 1997.

Value Comparison Unit (VCU)—area which generally encompasses a major watershed where resource inventories and interpretations are made.

Introduction

In compliance with the National Environmental Policy Act (NEPA) and other relevant laws and regulations, the Forest Service has prepared this Environmental Impact Statement (EIS) on the effects of timber harvest in the Sea Level Project Area (Figure 1-2) on Revillagigedo (Revilla) Island of the Ketchikan Ranger District/Misty Fiords National Monument (KM), Tongass National Forest. The proposed action would make available approximately 60 million board feet (MMBF) of timber, in multiple timber sales in the KM timber-sale program. This EIS discloses the direct, indirect, and cumulative environmental impacts and any irreversible or irretrievable commitment of resources that would result from each proposed alternative.

1 Purpose and Need

Decision to be Made

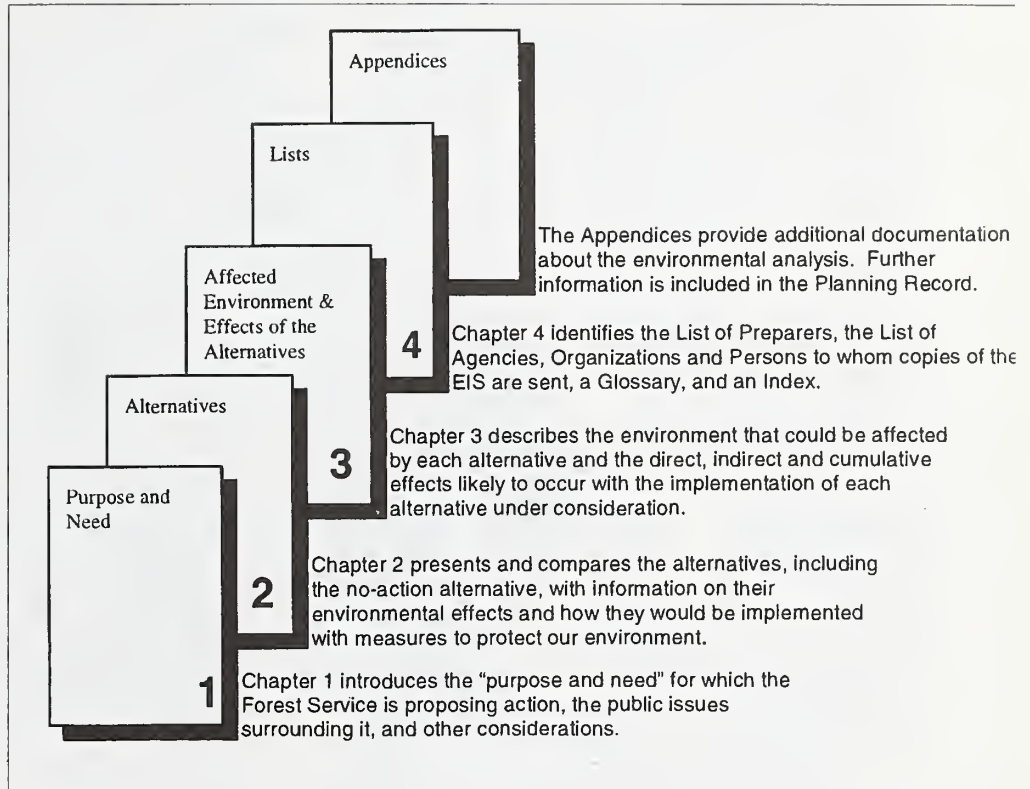
Based on the environmental analysis, the Assistant Forest Supervisor must decide whether or not, and if so how, to make timber available from the Project Area in accordance with the implementation of the Tongass Land Management Plan of 1997 (TLMP). The decisions will include:

- the approximate acreage to be treated in this area, in one or more timber sales,
- the locations of timber harvest units,
- the locations of roads and related facilities,
- adjustments to small old-growth reserves,
- subsistence findings, and
- necessary standards and guidelines, mitigation measures, and enhancement opportunities for sound resource management.

Document Organization

Chapter 1, in addition to explaining the purpose and need for the proposed action, discusses how the Sea Level Project relates to the TLMP and to other related actions, the key issues driving the EIS analysis, and the authorities guiding the EIS process. Chapter 2 describes and compares all alternatives. Chapter 3 describes the potentially affected environment and the anticipated effects of the alternatives on the natural and human environment in the Project Area and those areas directly affected by the proposed activities. Chapter 4 contains the list of authors, distribution list, glossary, index, and cited literature. Finally, a series of appendices provides helpful references to understanding the Final EIS. Additional documentation may be found in the Project planning record located at the Ketchikan Ranger District in Ketchikan, Alaska.

Figure 1-1
How This Document is Organized



Project Area

The Sea Level Project Area contains 91,747 acres of National Forest System lands and is located approximately 18 air miles east of Ketchikan, Alaska (Figure 1-2). It encompasses an area of south central Revilla Island that extends from Swan Lake south along both sides of Carroll Inlet and includes the lands adjacent to Thorne Arm. There are no communities within or adjacent to the Project Area. Access to the Project Area is by small plane or boat generally originating from Ketchikan.

The Project Area includes portions of Value-Comparison Units (VCUs) 746, 753, 754, 755, 756, 757, and 759 (Figure 1-3). The VCU boundaries generally follow major watershed divides with minor exceptions.

1 Purpose and Need

Figure 1-2
Project Area Vicinity Map

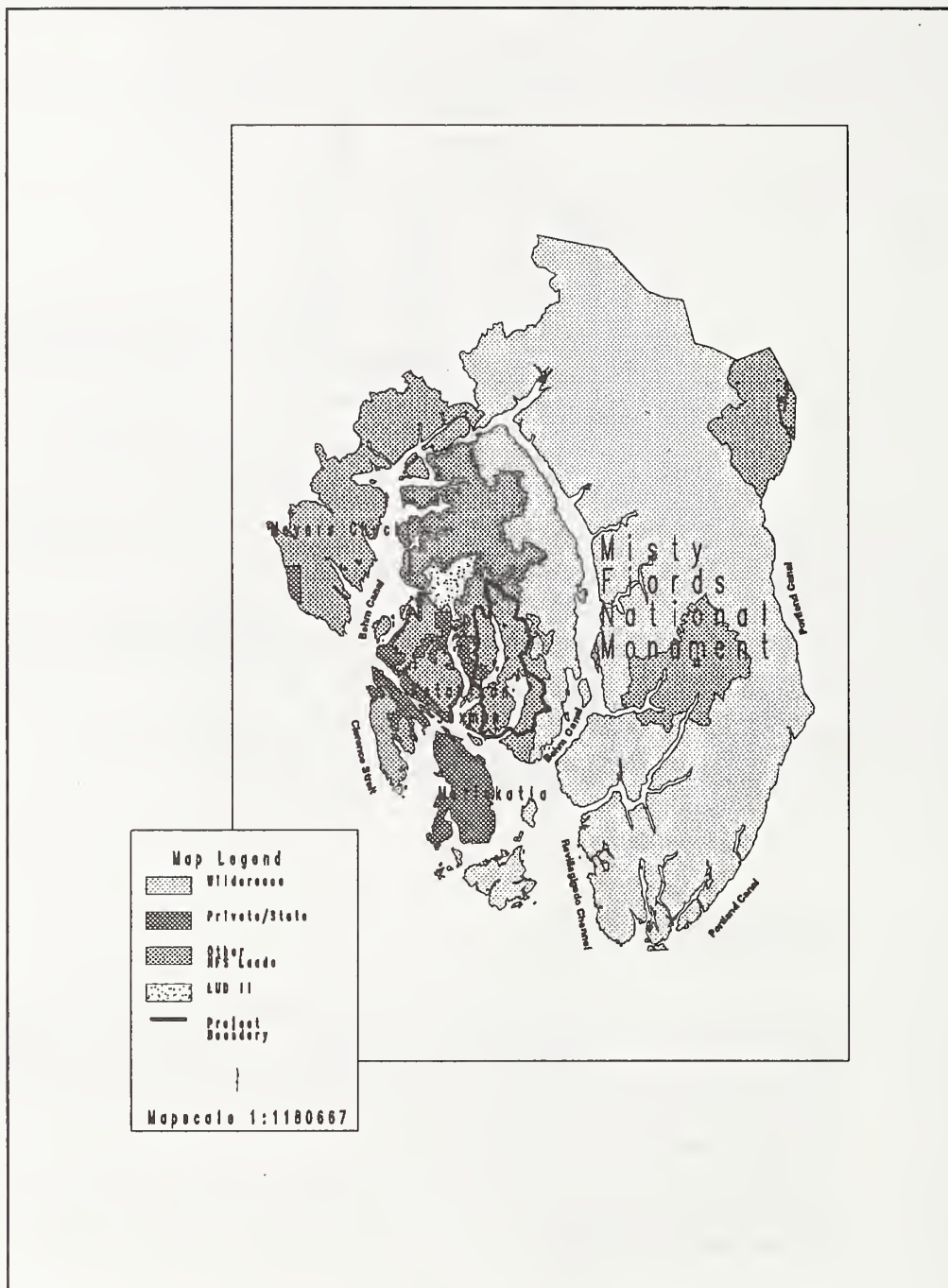
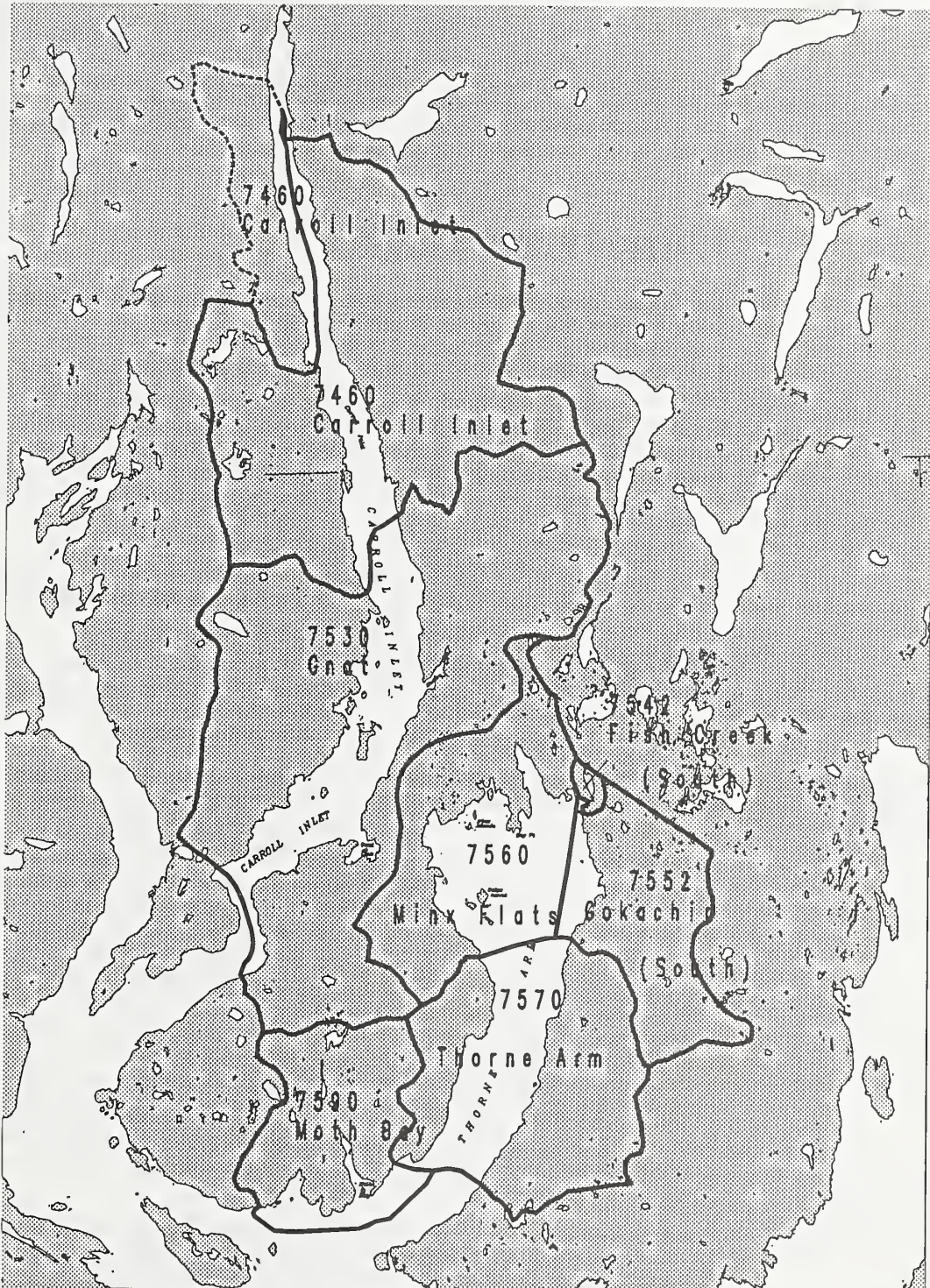


Figure 1-3
VCU Boundaries



1 Purpose and Need

Proposed Action

The proposed action would harvest approximately 60 MMBF of timber from an estimated 2,500 acres through a series of timber sales beginning in 1999. As many as 65 miles of new road would be built to facilitate timber removal. Three existing log-transfer facilities (LTFs), one re-constructed, would be utilized to implement the action alternatives.

The proposed action is consistent with the TLMP. Project implementation will help move the existing forest condition toward the desired future condition.

Purpose and Need

The Timber Sale is proposed to move the Project Area toward the desired future condition and to respond to the goals and objectives identified by the TLMP.

The TLMP identified Forest-wide multiple-use goals and objectives (TLMP, pp. 2-2 to 2-5). Forest-wide goals are achieved through the allocation of lands to Land-Use Designations (LUDs), through implementation of the standards and guidelines specified for the LUDs, and through other activities conducted on the Forest. Objectives are achieved by implementing the management prescriptions for each of the LUDs. Some of the goals and objectives listed for the Timber Production, Modified Landscape, and Scenic Viewshed LUDs include, among others:

- improve timber growth and productivity on suitable timber lands made available for timber harvest, and manage these lands for long-term sustained yield of timber,
- contribute to a timber supply to meet market demand, and
- provide opportunities for local employment in the wood-products industry, which in turn contribute to the local and regional economies of Southeast Alaska.

The Sea Level Project is designed to meet these goals and objectives.

Timber Growth and Productivity

Losses of the timber resource caused by age decay and disease are considerable in old-growth forests. It is not uncommon for well over 30 percent of the timber volume in old-growth stands to be defective and thus unusable for wood products. Tree vigor tends to decrease with maturity, causing an increase in susceptibility to pathogens and insects. Disease and decay processes are a natural part of forest ecosystems, and play a key role in providing wildlife habitat in old-growth forests. The TLMP allocated approximately 53 percent of the land within the Sea Level Project Area to the Timber Production LUD. The desired condition for this LUD, as identified by the TLMP, states that 'suitable timber lands are to be managed for the production of sawtimber and other wood products. Tree stands are healthy and in a balanced mix of age classes from young stands to trees of harvestable age.' (TLMP, p. 3-144). An additional 20 percent of the land within the Sea Level Project Area is allocated to the Modified Landscape and Scenic Viewshed LUDs, respectively. The desired condition for these lands is, in part, that they will produce a yield of timber which contributes to the Forest-wide sustained yield (TLMP, pp. 3-136 and 3-127). Harvesting aging stands, including those in declining health, on lands that allow timber harvest and replacing them with faster growing, healthy stands will reduce the volume loss associated with decay and disease and increase the growth and yield of the managed forest land.

The remaining 26 percent of the Project Area is allocated to nondevelopment LUDs; primarily Semi-remote Recreation (12 percent) and Old-Growth Habitat (12 percent). The desired condition for the Semi-remote Recreation LUD is to provide for recreation and

tourism in natural-appearing settings with ecological processes and natural conditions being only minimally affected by past or current human activities. The desired condition for the Old-Growth Habitat LUD states that all forested areas will have attained old-growth forest characteristics, providing a diversity of old-growth habitat types and associated species and subspecies and ecological processes.

Currently, western hemlock makes up 65 percent of the old-growth forests in the Project Area. Western hemlock is susceptible to dwarf mistletoe, a disease that does not infect Alaska yellow or western redcedar and rarely infects Sitka spruce. Western hemlock also appears to have more insect enemies than Sitka spruce. In addition, western hemlock has the lowest economic value of the four major commercial species in the Project Area. Harvesting existing stands dominated by western hemlock can encourage the growth of Sitka spruce and the cedars, creating a more diverse species mix and minimizing losses due to insects and diseases that are species specific.

Market Demand

Section 101 of the Tongass Timber Reform Act of 1990 (TTRA) provides direction to “seek to provide a supply of timber from the Tongass National Forest which (1) meets the annual market demand for timber from such forest and (2) meets the market demand from such forest for each planning cycle,” to the extent consistent with the multiple use and sustained yield of all renewable Forest resources and other direction. Market demand for Tongass National Forest timber is derived from factors which include: Southeast Alaska’s timber industry mill capacity, local, national, and international timber markets, and projected local, national, and world-wide timber supplies.

The Alaska Region uses the projections of the Pacific Northwest Research (PNW) Station to help determine demand for Tongass National Forest timber. The latest PNW Station market demand estimates for timber through the year 2010 are based on three scenarios of demand—low, medium, and high. In the low demand scenario, high stumpage, harvest, and manufacturing costs limit Alaska’s share of markets. Under the high demand scenario, increased harvest and manufacturing efficiency, with resulting lower costs, make Alaskan mills more competitive. Projected annual sawlog demand for the next decade is 113 MMBF for the low scenario, 133 MMBF for the medium, and 156 MMBF for the high scenario (TLMP, 1997).

There is a demonstrated mill capacity in the region to process logs, if supply of timber is available. There is also a projected need for the timber volume being considered from this Project Area for the Forest Service to come closer to meeting an objective of providing a supply of timber under contract to the existing dependent industry (see Appendix A), as a means of providing for stability in relation to fluctuating market demand. There is a substantial component of the economy of Southeast Alaska that is dependent on a viable timber industry.

Timber demand in Southeast Alaska can vary dramatically from year to year. The level of demand is dependent on complex interactions among factors that are difficult, if not impossible, for the industry or the Forest Service to predict with accuracy. Such factors include: fluctuations in interest rates, housing starts, business cycles in the United States and overseas, changes in the value of the dollar with respect to foreign currencies, changes in import tariffs, and changes in export policies in other countries.

The Forest Service intent is to provide the opportunity for the timber industry to acquire a supply of purchased, but unharvested timber equal to about 3 years of timber consumption. This supply is a means of providing for stability in relation to fluctuating market demand, considering the average rate of harvest for the past few years and any indicators of change in that rate from planning cycle projections or other sources. It is estimated that a 3-year supply of timber, based on medium-demand projections, is 399 MMBF.

1 Purpose and Need

As of September 30, 1998 there is 482 MMBF of unharvested timber volume under contract to the timber industry (Automated Timber Sales Accounting System Report 900, September 30, 1998). Of this volume, 226 MMBF is allocated to the Ketchikan Pulp Company under the terms of the long-term contract settlement agreement, and 256 MMBF is under independent industry contract. In order to meet the intent of having a 3-year supply, approximately 195 MMBF of timber needs to be cleared through the NEPA process and offered to industry. It takes approximately 3 years for timber to be cleared through the NEPA process. At this time, there is approximately 624 MMBF proposed under other ongoing NEPA analyses on the Tongass for the 1998 to 2002 period. Timber volume from the Sea Level Project Area will contribute to the 3-year supply.

Timber volume from the Project Area will provide a component of the 10-year timber program identified by the TLMP, which attempts to provide timber to industry in an even flow over the planning cycle. The TLMP states that the Ketchikan Area is expected to contribute up to a maximum of 121 MMBF per year for the next 10 years (TLMP 1997, Appendix L-8).

Appendix A of this EIS provides a detailed rationale for why the Sea Level Project Area was selected for analysis at this time. In summary, Appendix A states that the Project Area was selected at this time because:

- The TLMP allocated over 53 percent of the Project Area to a Timber Production LUD, with sufficient timber volume available to help meet market demand;
- Timber management activities will contribute to meeting the goals, objectives, and desired condition, for this LUD.
- most of the other Timber Production LUDs on the Forest have or are planning to have timber management activities scheduled in them;
- timber harvest infrastructure (roads, log-transfer sites, and rock quarries) are in place or in need of maintenance to reduce potential resource damage, and
- to provide local employment opportunities in the wood-products industry, consistent with providing for the multiple use and sustained yield of all renewable Forest resources.

The Sea Level Project is a component of the Ketchikan Area's timber management plan to contribute toward the volume identified by the TLMP sale schedule and will help meet TLMP goals and objectives. At this time, the Ketchikan Area has approximately 160 MMBF in additional volume undergoing NEPA analysis which could also contribute toward the sale schedule volume.

Local Employment Opportunities

Timber is one of several valuable resources on the Tongass and many people depend on it for their livelihood. It is harvested for sawn wood products such as lumber, cants, and wood-chip exports, and is the basis for a major industry in Southeast Alaska. The wood products industry in Southeast, including all timber harvesting and processing, provided about 2,070 direct jobs in fiscal year 1995 (TLMP).

The Tongass timber-sale program is part of a long-term cooperative between the Federal government, the State of Alaska, and local governments, to provide greater economic diversity and stability in Southeast Alaska and more year-round employment. The Sea Level Project would contribute to this, providing the opportunity for up to 6.71 jobs and \$316,806 in associated wages, per MMBF harvested. These per-MMBF figures are based on an average of wood-products employment from 1990-1994, less any pulp-mill employment (TLMP Final EIS). It is not clear how many jobs will be developed as operations adjust to take advantage of utility logs which are available for processing. As such, jobs and wages per MMBF will likely increase as the utility volume is processed.

Relationship of this Project to the Tongass Land Management Plan

The National Forest Management Act of 1976 (NFMA) directs each National Forest to prepare a plan to guide the management of its lands. The TLMP was completed in 1979 and amended in 1986 and 1991. The current TLMP was approved in 1997 (USDA Forest Service 1997), and now guides the management of the Tongass National Forest.

The Sea Level Project EIS is "tiered" to the revised TLMP Final EIS (USDA Forest Service 1997a), and also to the Alaska Regional Guide (USDA Forest Service 1983). General discussions from these documents and the administrative planning record are incorporated by reference rather than repeated in this EIS (see the Bibliography in Chapter 4).

Management Direction

The 1997 TLMP provides the primary direction for Forest management by means of the integrated components described in the following list.

- **Forest Multiple-Use Goals** are concise statements that guide the overall management of the Forest. These describe a desired future condition, expressed in broad, general terms, with no specific date by which the goals are to be achieved.
- **Forest Management Objectives** are objectives for specific resources and the levels of goods and services (resource outputs) that are anticipated, during the first decade of TLMP implementation. Objectives are designed to meet the goals.
- **Management Prescriptions** describe land uses and activities which may occur on specific areas of land. The management prescriptions in the 1997 TLMP include 19 LUDs (see Table 1-1), with a range of management objectives, and standards and guidelines to ensure attainment of those objectives.
- **Forest-Wide Standards and Guidelines** are the standards and guidelines that apply to all, or most, areas of the Forest. Each management prescription includes a list of standards and guidelines that apply to the appropriate LUD.

1 Purpose and Need

Table 1-1
Land-Use Designations as Defined in the TLMP

Non-Development LUDs		Development LUDs	
Wilderness and National Monument	Mostly Natural	Moderate Development	Intensive Development
Wilderness National Monument Non-Wilderness National Monument Wilderness	LUD II Old-Growth Habitat Research Natural Area Remote Recreation Semi-Remote Recreation Municipal Watershed Special Interest Area Wild River Scenic River Recreational River Experimental Forests	Scenic Viewsheds Modified Landscapes	Timber Production Minerals Transportation and Utility Corridors

Source: Tongass Land Management Plan Revision Record of Decision (USDA Forest Service 1997b).

Management Prescriptions

The 1997 TLMP allocates National Forest System land within the Sea Level Project Area VCU to six LUDs. Each of these six LUDs include management objectives and specific standards and guidelines. Standards and guidelines take precedence over annual targets or projected outputs; no project will be funded for which the standards and guidelines cannot be implemented. The TLMP LUDs in the Project Area are described below.

Timber Production—These lands are managed for the production of sawtimber and other wood products on an even-flow, long-term sustained-yield basis. An extensive road system will be developed for, accessing the timber, recreation uses, hunting, and fishing, among other public and administrative uses. Management activities will usually dominate most visible areas. A variety of wildlife habitats, predominantly in the early and middle stand-successional stages, are present. They comprise 53 percent of the nonencumbered National Forest System lands in the Project Area.

Modified Landscape—This LUD provides for a variety of uses. Timber harvest and roads are allowed and the yield contributes to the Forest-wide sustained yield. Management activities are subordinate to the characteristic landscape as seen in the foreground from popular travel routes and use areas. In the middle to background distance, management activities may dominate the characteristic landscape. A variety of stand-successional stages provide a range of wildlife-habitat conditions. The Modified Landscape LUD occupies 18 percent of the Project Area.

Scenic Viewshed—In areas managed under the Scenic Viewshed LUD, forest visitors and others using identified popular travel routes and use areas will view a natural-appearing landscape. Management activities in the foreground will not be evident to the casual visitor. Activities in the middle-ground and background will be subordinate to the characteristic landscape. Timber yields will contribute to the Forest-wide sustained yield. A variety of successional stages providing wildlife habitat occur, although late-successional stages predominate. The Scenic Viewshed LUD comprises 2 percent of the Project Area.

Semi-Remote Recreation—Areas in the Semi-remote Recreation LUD are characterized by generally unmodified natural environments. Ecological processes and natural conditions are

only minimally affected by past or current human uses or activities. Timber harvest and road construction are generally not permitted. This LUD occupies 12 percent of the Project Area.

Old-Growth Habitat—On lands within this LUD, old-growth forests are to be maintained and early seral conifer stands are to be managed to achieve old-growth forest characteristics. The objective is to achieve a diversity of old-growth habitat types and associated species and subspecies and ecological processes. Timber harvest is not permitted except to achieve the LUD objective, and roads and other facilities are to be avoided. These lands occupy 12 percent of the Project Area.

Wild River—The Wild River LUD is used to maintain the natural, free-flowing, and undisturbed condition of the river, or river segments. Ecological processes and changes predominate. The outstandingly remarkable values for which the river was designated are retained. Recreation users are to have the opportunity for experiences in the primitive and semi-primitive range, including solitude and remoteness in a natural setting. Forested lands are classified as unsuitable for timber production. This LUD comprises less than 1 percent of the Project Area.

Non-National Forest System Lands—These are State, private and other lands not managed by the Tongass National Forest. This is not a LUD, but an exclusion zone where National Forest management practices do not apply. Approximately 3 percent of the Project Area is comprised of non-National Forest System lands.

1 Purpose and Need

Table 1-2 displays the LUD acreage by VCU.

Table 1-2
Land Use Designations as Defined in TLMP

TLMP VCU Number	TM	ML	SV	SR	OG	WR	Non-NFS Lands	VCU Acres
746	16,203	6,459	1,736	0	2,064	0	103	26,565
753	16,506	7,177	0	3,644	2,270	0	2,899	32,496
745.2	0	0	0	130	0	254	0	384
755.2	3,730	613	0	0	3,422	372	118	8,255
756	5,449	1,533	0	0	1,222	0	0	8,204
757	8,053	1,154	0	0	1,923	0	0	11,130
759	0	0	0	7,575	0	0	152	7,727
Total Acres	49,941	16,936	1,736	11,349	10,901	626	3,272	94,761

TM—Timber Production

ML—Modified Landscape

SV—Scenic Viewshed

SR—Semi Remote Recreation

OG—Old-growth Habitat

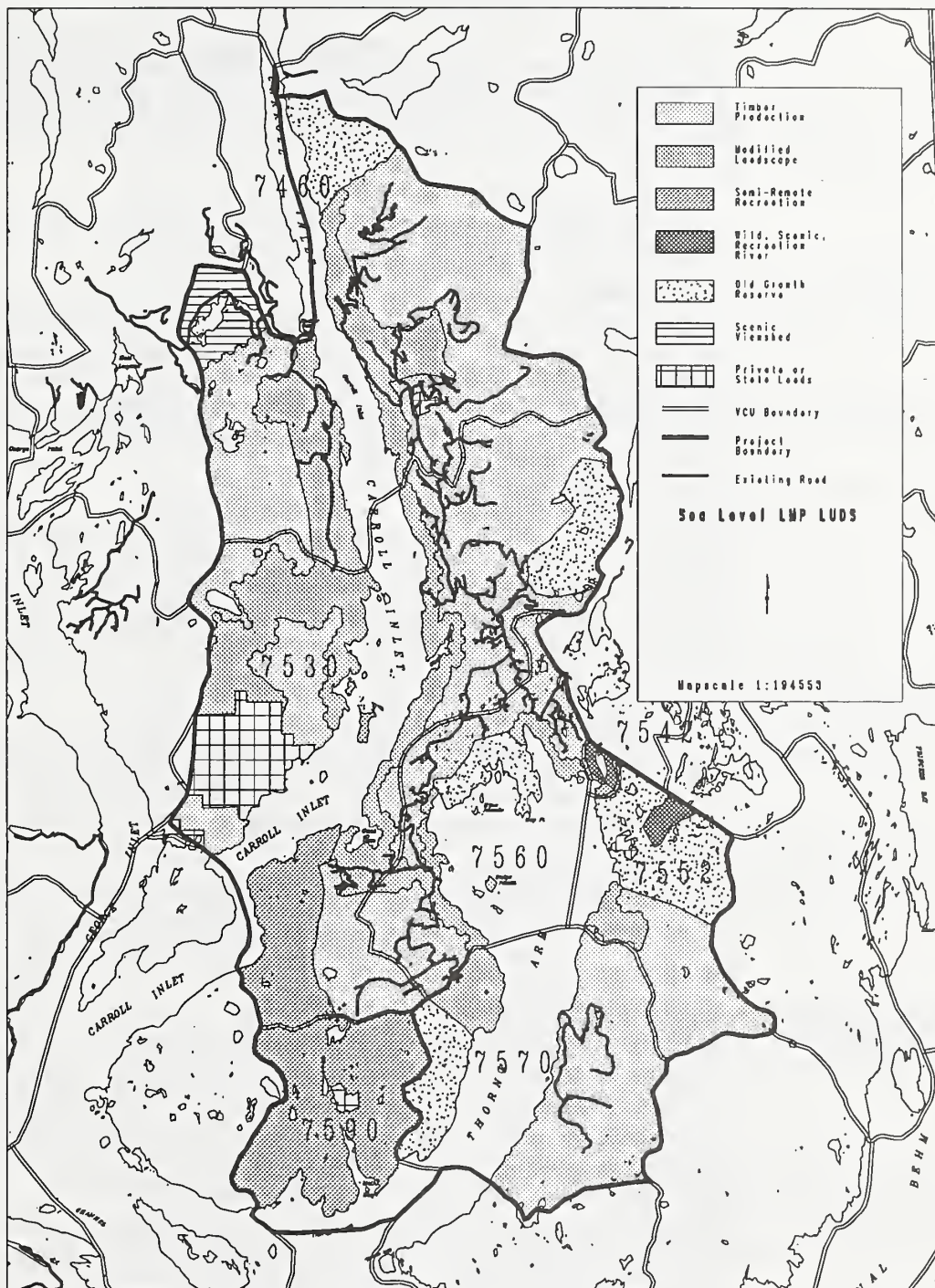
WR—Wild River

Non-NFS Lands—Non-National Forest System Lands

Note: Discrepancies may be found in numbers due to rounding.

Figure 1-4 displays the location of the 1997 TLMP LUDs within the Project Area.

Figure 1-4
Sea Level Project Area Land-Use Designations as Allocated in the TLMP (1997)



1 Purpose and Need

Public Involvement

Scoping

The NEPA process (40 Code of Federal Regulations 1501.7) was used to determine the scope of the issues to be addressed and to identify major concerns related to the proposed action. The scoping process was used to invite public participation and collect initial comments. The public was provided opportunities to comment on the Project at the following points during the process.

Notice of Intent (NOI)

A Notice of Intent was published in the Federal Register on May 9, 1997, when it was decided that an EIS was to be completed for the Project.

Public Mailing

On May 1, 1997, a letter providing information and asking for input was mailed to 623 individuals and groups that had previously shown interest in National Forest timber projects in Southeast Alaska. The mailing included 8 Federal agencies, 18 State agencies and divisions, 67 Native and municipal government offices, 213 businesses and other organizations and groups, as well as individual citizens. By the close of scoping, 49 responses to this initial mailing were received.

Local News Media

Announcements about the Project were printed in the Ketchikan Daily News, Island News, Wrangell Sentinel, Sitka Sentinel, Petersburg Pilot, and Juneau Empire. A scoping document describing the Project was placed in the May 10, 1997 Weekend Edition of the Ketchikan Daily News. A news release was issued to all Southeast Alaska news outlets (radio/TV/newspaper) on April 28, 1997, that described the Sea Level Project and how the public could be involved.

Open-House Meetings

Two open house public meetings were held during the scoping period to solicit comments. On May 21, 1997 at the Saxman Tribal House in Saxman, Alaska and on May 22, 1997 at the Cape Fox Lodge in Ketchikan, Alaska. Each meeting lasted from 7:00 to 9:00 PM, and was advertised in advance through the Ketchikan Daily News and on local radio stations.

Briefings/Consultation

Additional briefings were held from April 1997 through February 1998, to provide information, and clarify issues and alternatives for individuals and organizations. Consultation with Tribal, local, State and Federal government agencies also occurred during this time.

Open IDT Meeting

Preliminary Issues and Alternatives

A news release was issued on October 23, 1997, and then subsequently, an article regarding an upcoming open interdisciplinary meeting (IDT) meeting to discuss preliminary issues and alternatives, was featured in the Ketchikan Daily News on October 29, 1997. A letter, similar to the news release, was mailed on the same date to anyone who had submitted scoping comments. The Meetings and Brevities section in the October 30 and 31, 1997 Weekend Edition of the Ketchikan Daily News announced the open IDT meeting.

The purpose of the open IDT meeting was to provide the public a chance to comment on the significant issues and the range of alternatives identified for the Final EIS as a result of public scoping. The results of the meeting were documented in an article by the Ketchikan Daily News on November 1 and 2, 1997.

Draft EIS

Availability of Draft EIS for Public Comment

Availability of the Draft EIS was announced in the Federal Register on June 12, 1998, with a deadline for public comment listed as August 7, 1998. Written or verbal comments from interested parties were collected during this minimum 45-day comment period.

Subsistence Hearings

Subsistence hearings on the Draft EIS were held at the Saxman Community Hall Annex on July 16, 1998 and at the Metlakatla City Council Chambers on August 1, 1998. Open houses to describe the analysis process and to answer public questions were held in conjunction with the subsistence hearings. Public comment on the Draft EIS was also accepted at that time. Dates, times, and locations were publicized in the local media.

Final EIS

Analysis and Incorporation of Public Comments

Public comments and subsistence comments have been analyzed and incorporated into the Final EIS. Fifteen agencies and individuals submitted written comments on the Sea Level Draft EIS. For an analysis of public comment and Forest Service response to public comment, see Appendix G.

A letter was sent February 18, 1999 to interested parties to solicit public comment to the proposed change in the location of a small old-growth reserve. The decision has been made a part of the Record of Decision.

The Final EIS has been filed with the Environmental Protection Agency and is available to the public.

Issues

The significant public issues, management concerns, and resource opportunities identified through the public and internal scoping process were used to formulate issue statements. Issues were raised by individuals, organizations, and Federal, State, and local agencies, as well as affected Alaska Native governments. Similar issues and concerns were grouped when appropriate.

Issues 1 through 7 were determined to be significant and within the scope of the Project. All these issues will be addressed in all alternatives. Issues A to F were considered but eliminated from detailed study because their resolution either falls outside the scope of the Sea Level Project or they were resolved through application of appropriate mitigation measures across all alternatives.

Issues Associated with the Proposed Action

Issue 1: Timber Economics and Supply

This issue encompasses public concern over: the amount of timber available and proposed for harvest, methods of timber harvest, and balancing timber production with other Forest uses. It includes the issue of how the Project Area contributes to the timber supply. It also includes concern for ensuring cost-effective timber harvest.

Issue 2: Fish Habitat, Water Quality, and Soils

This issue addresses public concern for maintaining water quality in streams which provide suitable habitat for anadromous and resident fish. Fish and shellfish within the Project Area are important to sport, commercial, and subsistence users throughout Southeast Alaska. This issue also includes concerns about timber harvesting on steep slopes, mass movement of soil, stream temperature sensitivity, as well as karst and cave

1 Purpose and Need

Issue 3: Recreation and Scenic Quality

Forest management activities could affect existing recreational pursuits for users of the Project Area. More specifically, increased human access, timber harvest, and other developments could affect recreation values and opportunities, including hunting, fishing, scenic quality, and recreation use areas. Comments emphasized the importance of protecting the scenic quality along inlets and bays, particularly from the Fish Creek Cabin. The quality and types of recreation activities available to forest users could be enhanced by planning, facilitating, or developing a road system that, when eventually linked to Ketchikan, would allow increased access to existing and potential recreation sites.

Issue 4: Wildlife

This issue includes concerns over several wildlife species and the habitats critical to the maintenance of those wildlife populations. Alaskan wildlife is valuable for aesthetic, economic, recreational, ecological, and subsistence purposes. Of primary concern are the effects of timber harvest and associated road construction upon wildlife species dependent on old-growth habitat. Related to the overall concern is the question of how timber harvest would further fragment existing large blocks of old-growth habitat. The need for a project-specific old-growth habitat strategy (incorporating old-growth connectivity and open road densities) that ties into the TLMP habitat strategy was also identified.

Issue 5: Subsistence

Of primary concern is the potential effect of timber harvest and road construction on the abundance and distribution of subsistence resources. For many, subsistence consists of hunting, fishing, trapping, and gathering to supplement their food sources, income, and other needs. Other aspects to be evaluated are competition from non-rural subsistence users and access to the resources.

Issue 6: Social and Economic Effects

This issue reflects concerns about effects on community employment and income, population, community stability, and life-styles. The economies of most communities in Southeast Alaska depend almost exclusively on the Tongass National Forest to provide natural resources for uses such as fishing, tourism, recreation, timber harvesting, mining, and subsistence.

Issue 7: Marine Environment

The marine waters and their associated mud flats and estuaries found in protected coves and bays within the Project Area provide habitat for species such as Dungeness crab and juvenile salmon. Since coves and bays are the points of concentrated activity associated with marine transport of logs, logging camps, and sort yards, some marine species are subject to effects from log transfer and storage facilities. The use of three existing LTF sites is proposed.

The following public issues were considered but eliminated from detailed study because their resolution is beyond the scope of this document.

Issue A: Regional Timber Supply and Demand

Analysis of timber supply and demand is a regional issue which exceeds the scope of this analysis. This issue was addressed as part of the TLMP revision (TLMP, 1997a) process. A site-specific environmental analysis documents the effects of the proposed activities; it does not constitute the selling or conveyance of property rights. The volume of timber cleared in a NEPA document may be sold in whole, in part, or not at all, depending upon changing market conditions or other factors important in the overall management of the National Forests. Predicting the effects of the proposed activities upon the regional timber supply and demand is beyond the capability and scope of this document, other than concluding that timber sales that implement the Project will contribute volume to the timber supply and will help meet demand. How the PROJECT contributes to the long-term timber supply is addressed as part of Issue 1: Timber Economics and Supply.

Issues Outside the Scope of This Analysis

Issue B: Manage Sea Level for Sustained Yield

The National Forest Management Act (NFMA) directs that a sustainable level of harvest be identified for each National Forest. There is no direction or intent to establish a sustainable level of harvest for individual project areas or other small geographic subdivisions of the Forest. All alternatives considered meet TLMP standards and guidelines which ensure protection for multiple resource values over the entire Forest.

Issue C: Bradfield Road Transportation Link

Some members of the public expressed a concern that the Bradfield Road Transportation Link be evaluated in whole or in part in this EIS.

The Bradfield road connection (excluding Revillagigedo Island) is neither a connected action nor a reasonably foreseeable action ripe for decision.

Issue D: Below-Cost Timber Sales

Below-cost timber sales are a National issue and not within the scope of this Project. The financial impacts of the alternatives are displayed in Chapter 3 of this EIS.

Issue E: Ketchikan-Shelter Cove Transportation Link

This issue reflects the resource concerns as well as the opportunity to coordinate the construction of logging roads and potential future connections to the road system on other parts of Revilla, specifically Ketchikan to Shelter Cove. Several alternative routes could connect the Ketchikan road system to the Shelter Cove road system. All of these routes are outside the Sea Level Project Area, and no connection is anticipated under any alternative. A road connection would not be constructed and available for use for another 10 years. A preliminary analysis indicates that it would be cheaper to raft the logs back to Ketchikan or elsewhere, and therefore a timber sale would not facilitate a road connection in any case. While the two actions appear to be linked because of geography, the timing is not similar. Nor are the two actions inextricably linked; the timber sale may proceed without a road connection and a road connection may be constructed without a timber sale. The reasonably foreseeable cumulative effects of a road connection are, however, addressed in the Final EIS.

Issue F: Heritage Resources

The Project Area lies largely within the area traditionally claimed by two Southern Tlingit groups, the Tantakwan (also referred to as the Tongass or Ketchikan Tribe) and the Sanyakwan (also referred to as the Saxman or Cape Fox Tribe). Because of the importance of this area in preserving the Tlingit culture and traditional values, the Forest Service will continue to work closely with both the Tongass and Cape Fox Tribes to identify sites of cultural importance. Once identified, the Forest Service will protect these sites by avoiding them when planning and implementing management activities.

The National Historic Preservation Act (NHPA) directs Federal agencies to take into account the effect of proposed actions on historic properties. Historic properties are those properties included in or eligible for inclusion in the National Register of Historic Places. Federal regulations also require a "Section 106 review" for proposed actions. In response to this issue, we have completed the NHPA Section 106 review for all timber-harvest related activities proposed by the action alternatives. This includes units, roads, and LTF's. As a result of this review, we have avoided all known heritage resource sites in the Project Area or otherwise specified stipulations to protect them.

Federal and State Permits, Licenses, and Certifications

To proceed with the timber harvest as addressed in this EIS, a number of permits must be obtained from Federal and State agencies. Administrative actions on these permits would be initiated after the EIS is filed with the Environmental Protection Agency (EPA). The agencies and their responsibilities are listed below.

U.S. Army Corps of Engineers

- Approval of discharge of dredged or fill material into waters of the United States (Section 404 of the Clean Water Act of 1977, as amended).
- Approval of construction of structures or work in navigable waters of the United States (Section 10 of the Rivers and Harbors Act of 1899).

U.S. Environmental Protection Agency

- Storm-water discharge permit.
- National Pollutant Discharge Elimination System review (Section 402 of the Clean Water Act).

State of Alaska, Department of Natural Resources

- Authorization for occupancy and use of tidelands and submerged lands.

State of Alaska, Department of Environmental Conservation

- Certification of compliance with Alaska Water Quality Standards (Section 401 Certification).
- Solid Waste Disposal Permit (Section 402 of the Clean Water Act).

U.S. Coast Guard

- U.S. Coast Guard Bridge Permit (in accordance with the General Bridge Act of 1946) required for all structures constructed within the tidal influence zone.

Legislation and Executive Orders Related to this EIS

Shown below is a brief list of laws pertaining to preparation of EISs on Federal lands. Some of these laws are specific to Alaska, while others pertain to all Federal lands.

- Alaska Native Claims Settlement Act (ANCSA) of 1971
- Alaska Native Interest Lands Conservation Act (ANILCA) of 1980
- American Indian Religious Freedom Act of 1978
- Archeological Resource Protection Act of 1980
- Cave Resource Protection Act of 1988
- Clean Air Act of 1970 (as amended)
- Clean Water Act of 1977 (as amended)
- Endangered Species Act (ESA) of 1973 (as amended)
- Executive Order 11593 (cultural)
- Executive Order 11988 (floodplains)
- Executive Order 11990 (wetlands)
- Executive Order 12898 (environmental justice)
- Executive Order 12962 (aquatic systems and recreational fisheries)
- Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (as amended)
- Marine Mammal Protection Act of 1972
- National Environmental Policy Act (NEPA) of 1969 (as amended)
- National Forest Management Act (NFMA) of 1976 (as amended)
- National Historic Preservation Act of 1966 (as amended)
- Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601)
- Tongass Timber Reform Act (TTRA) of 1990
- Wild and Scenic Rivers Act of 1968 (amended 1986)

In addition, the Coastal Zone Management Act (CZMA) of 1976, as amended, pertains to the preparation of an EIS. Federal lands are not included in the definition of the coastal zone as prescribed in the CZMA. The Act, however, requires that activities of Federal agencies affecting the Coastal Zone be consistent to the maximum extent practicable with the enforceable policies of the approved State Coastal Management Program. This determination is made by the U.S. Forest Service.

The Alaska Coastal Management Plan incorporated the Alaska Forest Resources and Practices Act (1979) standards and guidelines for timber harvesting and processing. Standards and guidelines described in the TLMP, as well as other existing policy and direction in the Forest Service Manual and Handbooks, equal or exceed protection measures prescribed by State standards.

1 Purpose and Need

Availability of the Planning Record

An important consideration in preparation of this EIS has been reduction of paperwork as specified in 40 Code of Federal Regulations 1500.4. In general, the objective is to furnish enough site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated.

The planning record is available upon issuance of the EIS at the Ketchikan Ranger District/Misty Fiords National Monument, Ketchikan, Alaska. Other reference documents, such as the 1997 TLMP, are available at public libraries around the region as well as in all Forest Service offices.

Chapter 2

Alternatives

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Chapter 2

Alternatives

Key Terms

Alternative—one of several options proposed for analysis and decision.

Best Management Practices (BMPs)—practices used for the protection of water quality.

Desired Future Condition—a desired condition of the land to be achieved sometime in the future but has no specific date by which it is to be accomplished.

Diameter at Breast Height (DBH)—diameter of a standing tree at 4 feet, 6 inches above the root collar on the uphill side.

Old-Growth Blocks—contiguous blocks of wildlife habitat to be managed and conserved for breeding pairs, connectivity, and distribution of species of concern.

High-Value Marten Habitat—defined by the Tongass Land Management Plan as stands of high-volume productive old growth below 1,500 feet elevation.

Implementation Monitoring—collecting information to evaluate whether mitigation measures were carried as planned.

Logging System Transportation Analysis (LSTA)—design and mapping of potential timber harvest units, including logging methods and roads.

Mitigation—measures designed to counteract or reduce environmental effects.

MMBF—million board feet.

Roadless Area—an area of undeveloped public land with no improved roads, generally over 5,000 acres, as identified in the Tongass Land Management Plan.

Subsistence—customary and traditional uses by rural Alaskans of wild renewable resources for personal or family consumption.

Windfirm—individual trees or groups of trees that are able to resist being blown over by the wind.

Introduction

Chapter 2 summarizes the development of alternative actions for making timber available to the local forest products industry, while implementing the Tongass Land Management Plan of 1997 (TLMP) in the Sea Level Project Area. It also discusses the alternatives considered but eliminated from detailed study. Finally, this chapter explains and compares the four alternative actions selected for detailed study. Chapter 2 presents the alternatives in comparative form, sharply defining the issues to provide a clear basis for choice among options by the decision maker and the public.

Much of the information in Chapter 2 is summarized from Chapter 3, Environment and Effects. Chapter 3 contains the detailed scientific basis for establishing a baseline and

2 Alternatives

measuring the environmental consequences for each of the alternatives. For the best understanding of the four alternatives, readers should consult Chapter 3.

Alternative Development

Each alternative in this EIS presents a different approach to the issues. Four action alternatives are presented to meet the purpose and need of the Project, while minimizing or avoiding environmental impacts. Each action alternative represents a site-specific proposal developed through intensive interdisciplinary, unit and road design. Topographic maps, Geographic Information System (GIS) software, aerial photos, resource inventories and site inspections.

The alternative development process has been guided by several concepts and principals of sound resource management. Each alternative follows the standards, guidelines, and direction contained in the TLMP, the Alaska Regional Guide, and applicable Forest Service manuals and handbooks.

Ecosystem Management

Ecosystem management is a concept incorporated into forest management in recent years. The philosophy is to emphasize ecological, physical, and social sciences to guide resource management to sustain the health, productivity, and intangible values of the land. These concepts were considered in the selection and design of individual harvest units and roads included in the alternatives.

Ecosystem management looks at forest management on two levels: (1) the landscape level, which may be a geological province or a large watershed, and (2) the stand level, which deals with individual harvest units. The TLMP incorporates ecosystem management at the landscape level through land-use allocation and the development of standards and guidelines. This disperses incompatible uses and spreads impact out over time and space. Some issues, such as maintaining large unfragmented blocks of old growth over time, have been resolved through land-use allocation in the Forest planning process. A site-specific project-level plan implements that direction and responds to public comments through the development of alternatives which determine how stands are managed.

Some tools employed at the stand level may include:

- a deferred entry,
- reducing harsh edges through unit placement, looking for opportunities to retain small patches of uncut timber in harvest units,
- maintaining wildlife travel corridors,
- leaving snags in harvest units (where safety regulations allow), and
- trying nonstandard harvest practices where resource issues and physical limitations permit.

Process Used to Formulate Alternatives

An interdisciplinary approach was used to develop alternatives to the proposed action. The scoping process for the Sea Level Project Area began in May 1997 and concluded in October 1997. Subsequent alternative development addressed issues and concerns identified in scoping.

The Draft EIS for this Project was released in June, 1998. The intent of releasing a "draft" EIS is to allow the public to comment on the alternatives so that the agency can respond to the comments and consider the public input in making a final decision on the proposed action. A total of 15 written responses to the Draft EIS were received. This public input is considered in the final decision for this Project (see the Record of Decision). In response to public comments, some sections of the Final EIS have been changed, and corrections have been made in other sections. Specific responses to public comments are documented in Appendix G. All alternatives have been modified to varying degrees to address public comments and concerns. The following general guidelines were used to formulate alternatives:

Address the Issues Identified During the Scoping and Public Comment Periods

This ensures that the interests of the various citizens, groups, and organizations that could be affected by this Project are reflected in the alternatives.

Integrated Resource Analysis Focused on the Proposed Action

The TLMP implementation begins by comparing the existing condition with desired future condition and the management emphasis for the area. This is followed by a determination of what, if any, changes are necessary and what management practices can be used to achieve that desired future condition. The purpose of an integrated resource analysis is to determine what management practices best respond to the management emphasis and to ensure their consistency with TLMP direction.

Adherence to TLMP objectives and standards is an essential component of implementation. The list of possible management practices which would work toward the desired future condition for timber must be consistent with the need to meet TLMP standards and objectives for other resources.

Evaluate a Reasonable Range of Alternatives

Unresolved conflicts, identified by the Forest Service and the public, are the issues related to the proposed action. In responding to unresolved conflicts, not every conceivable alternative must be considered, but selection and discussion of alternatives must permit a reasoned choice and foster informed decision making and informed public participation. Taken together, these concepts help determine the range of alternatives.

The issues, ways of addressing the issues, and possible levels of resource use on Revilla Island, vary widely. The interdisciplinary team (IDT) provided a range of alternatives by varying the location and mix of resources committed under each alternative and by varying the number and kinds of activities to be conducted.

Upper limits on timber outputs and associated road mileages considered in this EIS are guided by TLMP standards and guidelines as well as requirements regarding timber harvest in the National Forest Management Act and its implementing regulations.

Lower limits on timber outputs and associated road mileages are directly related to the issues and concerns, as well as the purpose and need for action described in Chapter 1.

2 Alternatives

Consistency with TLMP and the Record of Decision

The Sea Level Project is consistent with the standards and guidelines in the TLMP. The documented analysis and relevant discussion from TLMP is incorporated by reference rather than repeated.

Alternatives Eliminated from Detailed Study

A number of alternatives were examined, but not considered for detailed study in this Final EIS. This section presents those alternatives and the rationale for excluding them from further consideration.

Alternative A

Single Resource or Issue

Alternatives that focused solely upon one resource or issue were eliminated from consideration as implementable alternatives. While alternatives constructed around a single resource may not be implementable, the issue itself may still be significant. Each alternative is evaluated against all the significant issues.

Alternative B

Shelter Cove Road Connection

The proposed Shelter Cove road connection is a separate project independent of the Sea Level Project. The road link project is a reasonably foreseeable but unconnected action. The Federal Highways Administration the lead agency. The preliminary preferred road connection alternative routes have been identified, and are located almost entirely outside the Sea Level Project Area. The two proposed actions appear to be connected because of the potential road locations and opportunity to haul harvested timber back to Ketchikan. The dissimilar time lines do not make the road connection available for the Sea Level Project. Preliminary analysis also indicates that the log haul back to Ketchikan by a connecting route would be uneconomical.

Alternative C

No New Road Construction

Several commentators asked the Forest Service to minimize or avoid the construction of new roads within the Project Area by harvesting only timber that is accessible from existing roads. An alternative of this nature would not meet the intended purpose and need of the Project. It would not be possible to access much of the suitable timber within the Project Area without new roads. This would consequently result in concentration of harvest on existing roads and areas close to potential helicopter drop points. This alternative would also adversely affect future economics of the suitable acres farthest from the road system by isolating them.

Alternatives Removed Between Draft and Final EIS

Alternative 3

Emphasis

The emphasis of this alternative was to provide the greatest potential for economic timber harvest. The location of harvest units, and selection of silvicultural prescriptions, logging systems, and transportation network are aimed at maximizing the appraised timber value. Following IDT analyses and deliberations, much of the emphasis and intent of Alternative 3 was incorporated into Alternative 7. It was also decided that to a large extent, Alternative 3 duplicated the emphasis and intent of Alternative 7 and was dropped from consideration and analysis in the Final EIS.

Alternative 4

Emphasis

The emphasis of this alternative was to meet the purpose and need while minimizing timber harvest in the Minx Flat area. No harvest units were selected in the Minx Flats area to maintain more connected habitat between the Carroll Point Medium Old-Growth Reserve and Misty Fiords National Monument, and also to address marten concerns in Value Comparison Unit (VCU) 7560. Alternative 4 also avoided harvest in the Sea Level Creek watershed. Following analysis, much of the emphasis and intent of Alternative 4 was incorporated into Alternative 7. It was also decided that to a large extent, Alternative 4 duplicated the emphasis and intent of Alternative 5 and was dropped from consideration and analysis in the Final EIS.

Alternative 6

Emphasis

The objective of this alternative was to respond to public comments suggesting that only Shelter Cove units be considered for harvest at this time. The remainder of the Project Area would be deferred to emphasize other resource values. It was determined that this Alternative did not adequately respond to the stated purpose and need for the Project. The Alternative responded to an issue of a very narrow scope, and therefore, was dropped from consideration and analysis in the Final EIS.

Alternatives Considered for Detailed Study

Four alternatives for making timber available to the timber industry from the Sea Level Project Area are considered in detail. Each alternative is consistent with the TLMP (1997). This section provides a discussion of: (1) the emphasis or intent of each alternative; (2) various resource outputs associated with implementation; and (3) environmental consequences. Alternatives are summarized in Table 2-2.

Alternative 1 (No Action)

Emphasis

This alternative would not propose any new timber harvest from the Sea Level Project Area at this time. It does not preclude timber harvest from other areas at this time, or from the Sea Level Project Area at some time in the future. This alternative serves as a benchmark by which effects of the action alternatives can be measured. See the fold-out, black and white, Current Condition map at the end of this chapter.

Outputs

There are no timber harvest outputs associated with this alternative. Management for visual quality, wildlife habitat, and semi-primitive recreation outputs would continue as it currently exists.

2 Alternatives

Alternative 2

Emphasis

This alternative accelerates progress toward the desired future condition for timber production while meeting TLMP standards and guidelines. The maximum amount of timber volume is made available. This alternative is designed to harvest as much of the Project Area as possible in a manner that meets standards and guidelines.

Outputs

This alternative would schedule the harvest of 2,857 acres, in 105 units for approximately 71 MMBF. Of this, 437 acres are planned for two-aged shelterwood with reserves, 1,140 acres are planned for two-aged clearcut with reserves, 348 acres are planned for even-aged clearcut, and 932 acres are planned for even-aged clearcut with reserve. It schedules 282 acres for helicopter yarding. There are 1,391 acres planned to be placed in reserves in this alternative. To implement this harvest, 51 miles of new road would be constructed, and 24 miles of existing road would be reconstructed. Road clearing will yield an additional 6 MMBF of right-of-way (ROW) volume. Preliminary analysis indicates a net mid-market stumpage value of \$86 per thousand board feet (MBF).

The use of three existing LTFs will be required to implement this alternative. Floating or land-based logging camps and log sort yards are anticipated with the Shelter Cove, Shoal Cove and Elf Point LTFs. The Alternative 2 map provides the spatial relationship among roads, units and other geographic features of the Sea Level Project Area. The Alternative 2 black and white, fold-out map illustrates the spatial relationship among roads, units, and other geographic features of the Sea Level Project Area.

Alternative 5

Emphasis

The emphasis of this alternative is to meet the purpose and need while avoiding timber harvest in the Minx Flats, Elf Point, and Marble Creek areas. This alternative minimizes harvest in the Minx Flats area to address wildlife-habitat-connectivity concerns in that area.

Outputs

Alternative 5 schedules the harvest of 30 units totaling 20 MMBF, from 867 acres. Of this harvest, 49 acres are planned for two-aged shelterwood with reserves, 234 acres are planned for two-aged clearcut with reserves, 76 acres are planned for even-aged clearcut, and 508 acres are planned for even-aged clearcut with reserves. It schedules 54 acres for helicopter yarding. There are 406 acres planned to be placed in reserves in this alternative. This alternative requires the construction of 17 miles of new roads and 17 miles of reconstruction. Road construction clearing will yield an additional 2 MMBF of ROW volume. Preliminary analysis indicates a net mid-market stumpage value of \$72 per MBF.

The use of two existing LTFs will be required to implement this alternative. Floating or land-based logging camps are anticipated with the Shelter Cove and Shoal Cove LTFs. The Alternative 5 black and white, fold-out map at the end of this chapter provides the spatial relationship among roads, units, and other geographic features of the Sea Level Project Area.

Alternative 7

Emphasis

The objective of this alternative is to emphasize timber economics by harvesting stands with the greatest potential for economic return, while addressing wildlife-habitat connectivity concerns. The location of harvest units, and selection of silvicultural prescriptions, logging systems, and transportation network are aimed to maximize the appraised timber value. This approach emphasizes a positive net economic return for the Project by seeking to minimize logging and road construction costs. This entry proposes only limited helicopter timber harvest. This alternative attempts to minimize impacts to old-growth habitat, wildlife travel corridors, riparian habitat, and wetlands.

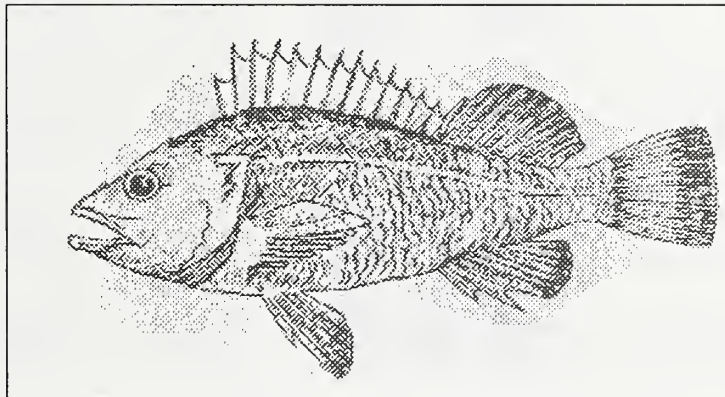
Outputs

Alternative 7 schedules the harvest of 68 individual harvest units, totaling 47 MMBF, from 1,828 acres. Of this harvest, 63 acres are planned for two-aged shelterwood with reserves, 665 acres are planned for two-aged clearcut with reserves, 177 acres are planned for even-aged clearcut, and 923 acres are planned for even-aged clearcut with reserves. There are 1,006 acres planned to be placed in reserves in this alternative. The alternative would require the construction of 30 miles of new road and 18 miles of reconstruction. Road clearing will yield an additional 4 MMBF of ROW volume. It schedules 43 acres for helicopter yarding. Preliminary analysis indicates a net mid-market stumpage value of \$91 per MBF.

The use of three existing LTFs will be required to implement this alternative. Floating or land-based logging camps and log sort yards are anticipated with the Shelter Cove, Shoal Cove, and Elf Point LTFs.

Forest Service Preferred Alternative

Comparing the benefits and adverse effects of each alternative against the issues, the Forest Service has identified Alternative 7 as the Preferred Alternative in this Final EIS. A final selection of an alternative has been made by the Forest Supervisor in the Record of Decision (ROD).



2 Alternatives

Comparison of Alternatives

The comparison of alternatives draws together the conclusions from the analysis presented throughout the document and provides a summary of the results. The following sections provide a comparison of alternatives by: (1) summary comparison of outputs and environmental consequences, (2) proposed activity, and (3) significant issues. Table 2-1 provides a summary of activities, outputs, and environmental consequences by which the alternatives may be compared.

Table 2-1
Summary Comparison of Alternatives

Activity/Resource	Units	Alternatives			
		1	2	5	7
Timber					
Units	Number	0	105	30	68
Estimated harvest-unit volume	MMBF	0	71	20	47
Estimated right-of-way (ROW) volume	MMBF	0	6	2	4
Two-Aged Systems		0			
Shelterwood with Reserves	Acres	0	437	49	63
Clearcut with Reserves	Acres	0	1,140	234	665
Even-Aged Systems	Acres	0			
Clearcut	Acres	0	348	76	177
Clearcut with Reserves	Acres	0	932	508	923
Total harvest	Acres	0	2,857	867	1,828
Shovel harvest	Acres	0	130	37	109
Cable harvest	Acres	0	2,445	776	1,644
Helicopter harvest	Acres	0	282	54	74
Estimated net-stumpage (mid-market rates)	\$/MBF	0	85.65	71.55	91.20
Total receipts to State of Alaska	\$Millions	0	4.61	1.42	3.21
Average annual jobs over 4 years	No. of jobs/year	0	150	43	99
Roads and Transportation					
New road construction	Miles	0	50.60	16.90	29.90
Road reconstruction	Miles	0	24.30	17.40	18.00
Roads crossing Class I or II streams	Number	0	18	10	13
Biodiversity					
Corridors connecting old-growth blocks	Acres Harvested	0	28	0	0
Old-growth acres remaining in Project Area	Acres	75,263	72,398	74,387	73,436
Percent of 1954 old growth remaining	Percent	86	83	85	84
Wildlife - 1997 Management Indicator Species					
Habitat capability for deer in the Project Area	Population Capability Numbers	3,794	3,590	3,686	3,641
Habitat capability for marten in the Project Area	Population Capability Numbers	145	138	143	140
Habitat capability for gray wolf in the Project Area	Population Capability Numbers	11	10	11	11
Subsistence - WAAs 405 and 406					
Deer habitat capability (percent of 1954)	Percent	67.00	58.00	61.00	60.00
Percent of 1954 needed to support current harvest	Percent	0.70	0.70	0.70	0.70
Ecological Landtypes					
Very high mass movement	Acres Harvested	0	0	0	0
High mass movement	Acres Harvested	0	1,367	283	649
Wetlands harvested	Acres	0	914	309	556
Wetlands roaded	Miles	0	34	12	22
Roadless Areas					
Roadless area remaining	Acres	47,588	34,868	44,776	44,777

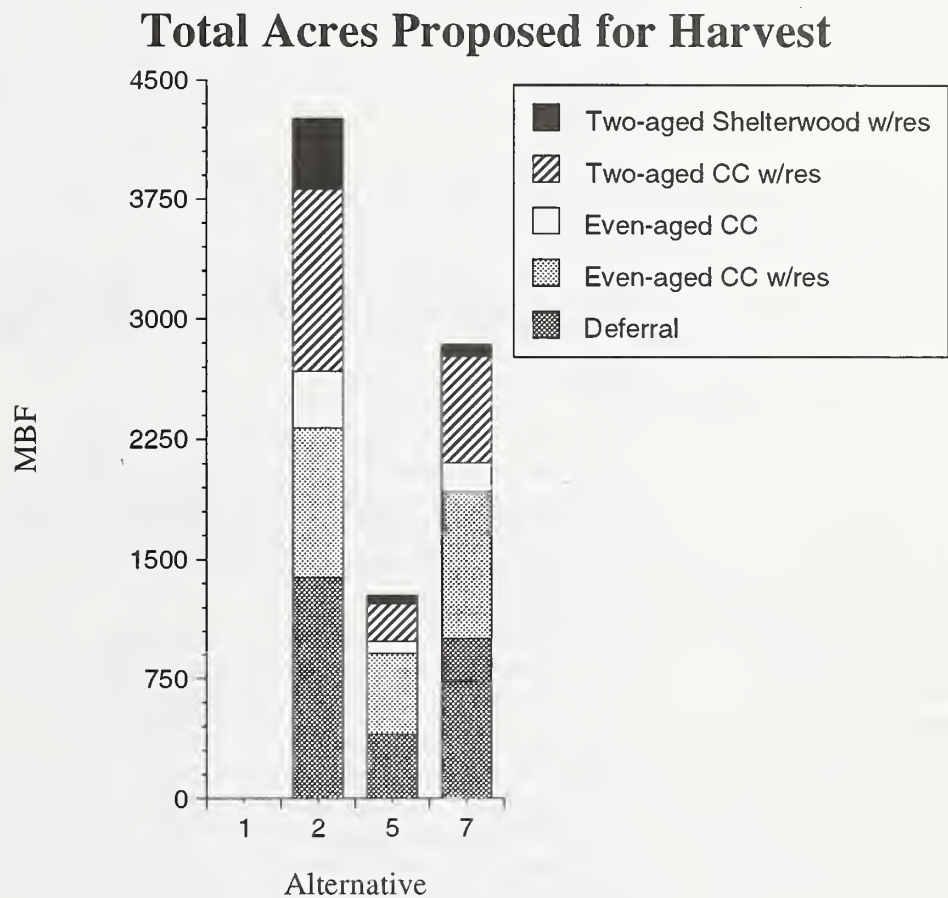
Source: IDT 1998.

Comparison of Alternatives by Proposed Activity

The action alternatives propose harvest of from 867 to 2,857 acres. Alternative 2 proposes the most acres for two-aged shelterwood with reserves harvest (437), while Alternative 5 proposes the least at 49 acres.

Of the action alternatives, Alternative 2 proposes the highest level of harvest; 71MMBF from approximately 2,857 acres. The Preferred Alternative (Alternative 7) provides 60 MMBF from approximately 2,500 acres. Alternative 5 provides the least volume at 20 MMBF from approximately 867 acres. Figure 2-1 shows the number of acres proposed for harvest by each alternative by silvicultural system.

Figure 2-1
Total Acres Proposed for Harvest



Source: Trulock, 1999.

2 Alternatives

Road development is divided into two categories, construction and reconstruction. Table 2-1 shows the number of miles of road construction and reconstruction proposed to access the harvest units for each alternative. Alternative 2 proposes the most road construction (50.0 miles) and reconstruction (47.5 miles) while Alternative 5 proposes the least amount of road construction (16.9 miles) and reconstruction (17.2 miles).

There are three existing LTFs to implement the various alternatives. The IDT has projected which units or groups of harvest units would most economically be hauled to a given LTF. Table 2-2 shows the volume of harvest projected to be hauled to each LTF.

Table 2-2
Proposed Harvest, by Log-Transfer Facility, in MMBF

	No Action	Alt. 2	Alt. 5	Alt. 7
Shoal Cove	0	36	14	22
Shelter Cove	0	18	9	15
Elf Point	0	19	0	12

Source: Griffin, 1999.

Note: Does not include road right-of-way volume

Comparison of Alternatives by Significant Issue

Chapter 1 presents the significant issues that are the focus of this EIS and the key indicators for evaluating the impacts of timber harvest on each issue. This section compares the alternatives in terms of these issues. The baseline for comparing alternatives is Alternative 1, the No-Action Alternative. Chapter 3 contains the detailed evaluation of the potential effects of timber harvest and road construction activities under each alternative on Forest resources.

Issue 1 Timber Harvest Economics and Supply

Logging Systems

This issue encompasses public concern with the amount of timber available and proposed for harvest, methods of timber harvest, and balancing timber production with other Forest uses. It includes the issue of how the Project Area contributes to the timber supply. It also includes concern for ensuring cost-effective timber harvest.

The estimated timber economics focus on the residual value (stumpage) of the timber after all associated logging and transportation costs are subtracted. Generally, the most expensive logging method is helicopter, followed by slackline, highlead, live skyline (shotgun), running skyline and shovel yarding. The average yarding distance, uphill versus downhill yarding, volume per acre, species composition and value, in combination with other factors, will influence the relative cost of each yarding method. Helicopter yarding is necessary in areas where it is impractical to build road or where aerial logging is necessary to meet specific standards and guidelines. Alternative 2 proposes the most helicopter acreage (282), while Alternative 5 proposes the least. Table 2-2 displays the acres of harvest proposed for each logging system in each alternative.

Issue 2 Fish Habitat and Water Quality

Midmarket Value

The analysis of timber values in the Timber section of Chapter 3 looks at the midmarket estimates for each alternative. Alternatives 2, 5, and 7 have positive value at midmarket.

Table 2-1 compares the economics of timber harvest in dollars per thousand board feet (\$/MBF) for each alternative under midmarket conditions (generally representing the average market condition and product mix). The stumpage value expresses the net dollar value of the timber volume after subtracting the production, manufacturing and profit/risk costs from the log values.

Timber Supply

The Sea Level Project Area is composed of moderately difficult topography from a logging standpoint. Alternatives 2, 5, and 7 would harvest 2,857 acres, 867 acres, and 1,827 acres respectively (see Table 2-1).

Public concern has been focused on the effects of timber supply on community stability and rates of harvest scheduled in the TLMP. The TLMP has addressed this issue by incorporating updated information into the TLMP which includes not only the effects on timber supply, but land-use allocations and revised standards and guidelines. The Timber-Sale Action Plan in Appendix A of this document reflects the updated TLMP and its relationship to the Sea Level Project Area. The Sea Level Project is consistent with TLMP standards and guidelines.

Best Management Practices

We anticipate no measurable effects on water quality or fisheries production by any of the timber harvest or associated activities proposed by any of the action alternatives. All alternatives meet the requirements and intent of the Clean Water Act. Implementation of site-specific riparian management direction effectively mitigates direct stream channel impacts from proposed timber harvest and road construction. Adherence to Best Management Practices (BMPs) outlined in the Soil and Water Conservation Handbook (Forest Service Handbook 2509.22) during the design of units and roads minimize the potential direct effects to fish as well. Site-specific BMPs are noted on the individual unit and road cards in the Sea Level ROD, Appendices 1 and 2.

Stream Crossings

Another measure of potential risk to fish habitat from timber harvest is the associated new road construction and road reconstruction which crosses streamcourses (see the Aquatics section and Roads section in Chapter 3). During placement of culverts or bridges, sediment is introduced into streams which will have short-term effects on water quality. Improper application of BMPs could result in long-term habitat degradation. Alternative 5 proposes the fewest stream crossings, while Alternative 2 proposes the most.

Landslide Potential

Following timber harvest, there is an increased risk of landslides until second growth and the brush layer become firmly established. One way of analyzing this risk is to determine the amount of timber harvest on slopes which have high mass-movement index (MMI) soils. This rating does not imply that such a mass-wasting event will occur; rather, it ranks the alternatives on the basis of the potential for a mass-wasting event to occur, which may or may not result in an increase in stream sediment. Increased stream sedimentation can result in loss or impairment of fish spawning and rearing habitat. Summary Table 2-2 displays the proposed harvest on high MMI and very high MMI soils by alternative. Virtually all very high MMI soils have been removed from the timber base. Only those sites that appear to be small inclusions have been retained in the unit pool. These sites have been examined by a professional soil scientist during unit reconnaissance.

2 Alternatives

Sediment Transfer and Deposition

A number of watersheds were evaluated for sediment delivery and depositional potential using a watershed-level analysis. The watersheds were divided into sub-basins and reaches. Sediment transport and deposition indices were developed based upon watershed morphology, discharge, and potential sediment sources. This sediment transfer index indicates where in a watershed, sediment production and deposition is a potential problem for maintenance of aquatic habitat. The quantity of sediment transported and deposited depends upon a number of factors, including the nature of sediment source, stream discharge, and channel morphology. These are factors that resource managers consider when planning activities on areas linked to important aquatic habitat.

Results of sediment transport and deposition-risk assessment for roads and units in the Sea Level action alternatives indicate that Alternative 5 has a lowest overall risk of sediment delivery to streams. Alternative 5 harvests the fewest acres, and avoids most sensitive areas. Alternative 7 reduces overall risk by minimizing harvest unit location and road construction near some stream courses. Alternative 2 poses the highest risk of sediment delivery from road-related sediment.

Issue 3 Recreation and Scenery

Scenery

Management activities could affect existing recreational pursuits of users of the Project Area. Increased access, timber harvest, and other developments could affect recreation values and opportunities, including hunting, fishing, scenery, and existing recreation use areas. Comments from the public mentioned the importance of protecting the scenery along inlets and bays, particularly around the Fish Creek Cabin. The quality and types of recreation activities available to Forest users could be enhanced by developing a road system that, when linked to Ketchikan, would allow increased access to existing and potential recreation sites. Other aspects of this issue were related to the visual impacts to flightseeing.

There are six key viewsheds within the Project Area. The proposed visual quality objectives (VQOs) for this Project establish the minimum scenery management standards for these key viewsheds: Saddle Lakes, Middle Carroll Inlet, Lower Carroll Inlet, Upper Thorne Arm, Lower Thorne Arm, and Fish Creek. Alternative 1 represents the existing scenery. In all alternatives, for all viewsheds, the proposed harvest units achieve the adopted VQOs.

Roadless Areas

The TLMP EIS identified two roadless areas which lie within or partially within the Project Area. The impact of timber harvesting on roadless areas is much larger than the acres harvested because the sights and sounds associated with the harvest activity affect the surrounding area. Roadless areas need to be 5,000 acres to be considered potential candidates for Wilderness. Table 2-1 displays the acres of roadless area that will remain after implementation of each alternative. Alternative 1 does not affect the roadless areas. Alternative 2 would reduce the roadless area acreages the most (by 12,720 acres). Alternative 7 and 5 would reduce roadless area acreages the least (by approximately 2,800 acres).

Issue 4 Wildlife Habitat

This issue includes concerns over several wildlife species and the habitats critical to maintenance of those wildlife populations, as Alaskan fish and wildlife are valuable for aesthetic, economic, recreational, and subsistence purposes. Of primary concern are the effects of timber harvest and associated road construction upon wildlife species dependent on old-growth habitat. Related to the overall concern is the question of whether timber harvest operations would further fragment existing large blocks of old-growth habitat and result in declines in biological diversity. The need for a Project-specific old-growth habitat strategy (incorporating the issues of connectivity and open-road densities) that ties into a larger-scale (TLMP) habitat strategy was also identified.

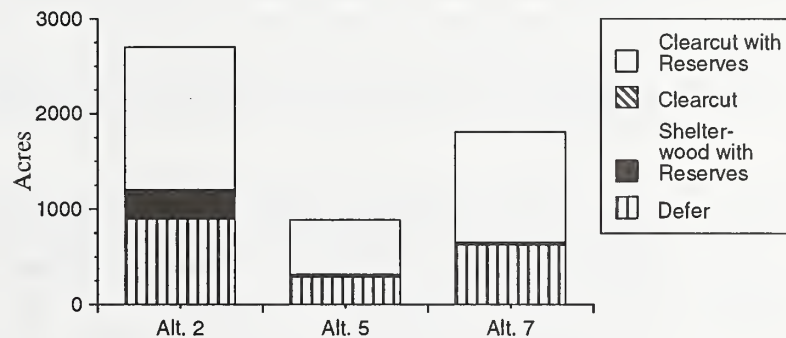
The major effect on wildlife habitats in all action alternatives is the reduction of old-growth-forest habitat. Impacts to other habitats were reduced by the interdisciplinary

design of units prior to alternative formulation. Old-growth forest will be reduced as shown in Table 2-1. All alternatives result in impacts consistent with the implementation of the TLMP goals, objectives, and standards and guidelines.

Table 2-1 displays wildlife habitat capabilities, as estimated by habitat capability models, for the key Management Indicator Species (MIS) found in the Project Area.

The TLMP defined high-value marten habitat as stands below 1,500 feet elevation in high-volume productive old-growth strata. There are approximately 19,821 acres of high-value marten habitat in the Project Area. Figure 2-2 shows a comparison of the amount of TLMP high-value marten habitat harvested under each alternative.

Figure 2-2
Acres of TLMP High-Value Marten Habitat Treated in the Sea Level Project Area, by Alternative



Source: Burns 1999. Data derived from GIS database.

In all action alternatives, over half of the TLMP high-value habitat treated is treated using clearcuts. About twice as many acres are harvested using clearcut with reserves and even-aged clearcut as are deferred from harvest. Acres with two-aged shelterwood with reserves treatments fall into two categories. Those in VCUs with less than 33 percent of the productive old growth harvested retain 10 to 20 percent of the original stand structure per TLMP marten standards and guidelines. Those VCUs with over 33 percent of the productive old growth harvested retain 30 percent canopy closure to meet TLMP marten standards and guidelines.

Forest fragmentation represents a change in the overall forest landscape from large, contiguous blocks of old-growth forest to smaller blocks separated by timber harvest units. Increased amounts of forest fragmentation indicate reduced habitat potential for species which are thought to be dependent on interior old-growth forest habitat. One way to analyze forest fragmentation is to measure the reduction of large, contiguous blocks of old-growth forest as a result of timber harvest. Table 2-1 displays the number of acres of old-growth habitat that will remain after implementation of an alternative.

Large and medium-sized blocks of old growth (Misty Fiords National Monument, Carroll Point, and Swan Lake) are adjacent to the Project Area. Several small reserves of unfragmented old-growth habitat are located inside the Project boundary. Alternative 7

2 Alternatives

Issue 5 Subsistence Use

recommends moving the small old-growth habitat reserve in VCU 7560 from Mop Point to the Gnat Cove area. Moving the small old-growth habitat reserve in VCU 7560 from its current location to the location proposed in Alternative 7 would reduce the suitable timber base by approximately 315 acres and 9,835 MBF. The existing suitable timber base in the Project Area would be reduced from 17,096 acres and 516,194 MBF to 16,781 acres and 506,359 MBF. None of the other alternatives propose harvest in small, medium or large old-growth reserves as established in TLMP.

Late-succession-forest corridors that provide connectivity between core areas of unfragmented old-growth habitat were identified. Alternative 2 would impact the corridors the most (28 acres). Alternatives 5 and 7 do not harvest any of the connecting corridors.

All alternatives are consistent with the viable-population strategy in the TLMP.

Of primary concern is the potential effect, as well as the cumulative effects, of timber harvest and road construction upon the abundance and distribution of subsistence resources. For many, subsistence consists of hunting, fishing, trapping, and gathering, to supplement their food sources, income, and other needs. Aspects to be evaluated are, competition from nonrural subsistence users and access to the resources.

Chapter 3 evaluates the potential site-specific effects on subsistence that could result from implementing any of the proposed timber harvest and associated road-construction alternatives.

The Tongass Resource Use Cooperative Survey (TRUCS) identified areas which are most heavily used by subsistence households. Based on the TRUCS, the Project Area contains no high- or moderate-use subsistence areas. High and moderate use is interpreted to mean greater than 50 households ever used the area for subsistence deer hunting.

Deer hunting is one aspect of subsistence use affected by timber harvest. The Wildlife and Subsistence sections of Chapter 3 discuss the computer models used to estimate the effects of timber harvest on deer-habitat capability; both long range and short range. Based on this analysis, Alternative 1 will cause no reduction of deer-habitat capability. Among the action alternatives, Alternative 5 would cause the least reduction to deer-habitat capabilities, while Alternative 2 would reduce deer-habitat capabilities the most.

The Project Area is located within portions of two Wildlife Analysis Areas (WAAs), 405 and 406. The average rural harvest is about 4 deer per year based on ADF&G hunter surveys for both complete WAAs. Approximately 1 percent of the original (1954) habitat capability is needed to support this level of deer harvest. Currently (1999) the Project Area provides 67 percent of the original habitat capability for deer. The habitat capability through the year 2045 is projected to be approximately 60 percent of the original (1954) habitat capability.

Table 2-1 displays the percent of 1954 deer-habitat capability for each alternative compared to the percent needed to support current deer harvest levels in WAAs 405 and 406.

Competition for subsistence resources in the Project Area is an issue. Subsistence users are concerned with competition from residents of Ketchikan. Since Ketchikan residents are considered nonrural, this competition from sport hunters can be regulated by the State of Alaska if it starts to restrict rural residents' ability to obtain subsistence resources. In the Wildlife Section, of Chapter 3 the cumulative analysis discussed a potential road connection between Shelter Cove and Ketchikan. If such a connection is made, it could increase the amount of sport hunting and subsistence use of the Area. This may lead to an increase in the amount of competition to the point that there could be a significant restriction in subsistence use of deer and marten in the Project Area.

At that point the Federal Subsistence Board could exercise its authority to regulate sport hunting harvest of deer and prioritize the harvest of deer among subsistence residents to protect the resource. The current deer population level does not require restrictions on sport hunters.

Deer populations are expected to remain at levels that will support current and projected subsistence demand through the year 2045. The analysis indicates that the actions proposed in Alternatives 2 through 7 will not represent a significant possibility of a significant restriction on subsistence use of deer, black bear, wolf, marten or otter in the Project Area. This is based on a comparison between harvest levels and habitat capability in the Project Area.

There is no evidence to indicate that availability of salmon, finfish, shellfish, or other food resources to subsistence users would be affected by sport or nonrural harvest. Any increase in competition from nonrural Alaskan residents and nonresidents would not be substantial because of the availability of resources in the immediate vicinity and in the surrounding areas.

This issue reflects concerns about effects on community employment, income, community stability, and life-styles. The economics of most communities in Southeast Alaska depend almost exclusively on the Tongass National Forest to provide natural resources for uses such as fishing, tourism, recreation, timber harvesting, mining, and subsistence. Many Southeast Alaskans want to maintain the natural environment which makes their life-style unique. At the same time, they want to maintain their economic livelihood.

The State of Alaska receives 25 percent of the sum of all net receipts from timber sold on National Forest System Lands plus any purchaser road credits. This money is earmarked for public schools and roads. Table 2-3 shows the estimated returns to the State of Alaska and the Ketchikan Gateway Borough (KGB) from the harvest of timber (from this Project only) by alternative. Actual returns will be based upon sale volumes, appraised rates, bid premiums, and may differ from this estimate, which is based on midmarket rates.

Table 2-3
Estimated Returns to State of Alaska from Sale of Timber*

Alternative	Total MMBF	Total Dollars	State of Alaska Dollars	KGB** Dollars
1	0	0	0	0
2	77	6,614,664	4,611,344	205,666
5	22	1,585,763	1,421,756	63,410
7	51	4,640,621	3,206,964	143,031

Source: Marks, 1998.

* Based on midmarket rates timber receipts.

** Based on historical average distribution of 4.46 percent of total Tongass receipts going to KGB.

Issue 6 Social and Economic Effects

2 Alternatives

Table 2-4 displays the employment (jobs) and personal income (salaries) associated with each alternative averaged over a 4-year period. The jobs and salaries listed include those both directly and indirectly dependent upon the timber industry.

Table 2-4
Timber Industry Average Annual Employment and Income by Alternative

	Alternative			
	1	2	5	7
Volume Harvested (MMBF)	0	77	22	51
4-Year Average	0	19	6	13
Employment (Jobs/year)	0	127	40	87
Personal Income (Million\$/year)	0	40	13	28

Source: Schaefers, 1998.

Under Alternative 1, the No-Action Alternative, none of the employment described above would result from timber harvest in the Project Area. This would have a negative effect on timber-harvest employment if timber purchasers are not be able to substitute volume from other sources. The effects of Alternative 1 are not predictable and could range from elimination of shifts to partial or full shutdown of local mills for unspecified periods of time.

The projected long-term effects of different harvest levels on the Tongass National Forest are contained in the TLMP Final EIS. The TLMP analysis takes into account falldown resulting from additional streams, blind leads, unsuitable soils, and a number of other factors.

None of the alternatives is expected to have a significant direct impact on the commercial fishing, recreation, or tourism industry, or employment related to those industries.

The marine waters and their associated mud flats and estuaries found in protected coves and bays within the Project Area provide habitat for species such as Dungeness crab and juvenile salmon. The Project Area includes Thorne Arm and Carroll Inlet which are important commercial, subsistence, and sport fishing areas. Since coves and bays are the points of concentrated activity associated with marine transport of logs, logging camps, and sort yards, some marine species are subject to effects from log transfer and storage facilities. Three existing LTFs will be used in the alternatives.

Direct effects to the marine environment are assumed to occur only from development and use of LTFs, and are limited to the intertidal area affected by rock fill and either the intertidal or subtidal areas potentially affected by accumulations of bark debris.

There are three existing LTF sites scheduled for use on this Project. The maximum number of LTFs that would be utilized under any alternative is three. All three sites are existing, permitted LTF sites. Table 2-5 displays the LTFs involved in the various alternatives. See also the detailed black and white, fold-out alternative maps at the end of this Chapter.

Issue 7 Marine Environment

Table 2-5
Log-Transfer Facilities Required, by Alternative and System

Site Name	Site Number	Alternative				LTF System
		1	2	5	7	
Elf Point	1	N	I	N	I	Barge
Shelter Cove	2	N	I	I	I	A-Frame
Shoal Cove	3	N	I	I	I	A-Frame

Source: Oien, 1998.
I = Planned for intermittent use.
N = Not planned for use.

Table 2-6 displays the number of LTFs used or developed, the total acreage of the structural embankment, and the estimated acres to be affected by bark deposition. The combination of the marine habitat covered by the structural embankment and the area potentially covered by bark deposition represents the total loss of marine benthic habitat for each alternative.

Table 2-6
Marine Benthic Habitat Acres Affected by Alternative

	Alternative			
	1	2	5	7
Existing LTF Sites	3	3	3	3
Structural Embankment	0.46	0.46	0.46	0.46
Bark Deposition	2.00	2.00	2.00	2.00
Total Acres of Marine Benthic Habitat Affected	2.46	2.46	2.46	2.46

Source: Oien, 1998.

Alternative 1 (No-Action Alternative) would have no measurable additional effect on the marine environment, while Alternatives 2, 5, and 7 affect the marine system in a similar fashion (2.46 acres). The loss of habitat is much less than 1 percent of the available marine habitat in the Project Area. Since all species identified along the subtidal (underwater) survey transects are common throughout Southeast Alaska, it is concluded that there would not be a significant impact to the marine environment from continuing to use LTFs at the existing sites.

2 Alternatives

Mitigation

TLMP Mitigation

The Forest Service uses many protective measures in the planning and implementation of projects. The application of these measures begins during the planning and design phases of a project. The standards, guidelines, and direction contained in the TLMP, Alaska Regional Guide, and applicable Forest Service manuals and handbooks have been applied in the development of alternatives and design of harvest units and roads.

Public comment on the Sea Level Draft EIS helped identify when and where additional mitigation measures should be considered. Listed below is a summary of some of the mitigation measures common to all alternatives. Specific mitigation measures, as applied to each individual unit, can be seen in the "As Planned" Unit Design and Road Cards in Appendices 1 and 2 of the ROD. These unit and road cards are an important tool for implementing the Project, as they list applicable standards and guidelines and provide a mechanism for tracking Project implementation. Unit Design and Road Cards have been developed for each individual unit that occurs in the Preferred Alternative.

Water Quality and Fish Production

TTRA, Best Management Practices

Mitigation to protect water quality, fish habitat, and wetlands includes application of the BMPs stated in the Soil and Water Conservation Handbook (USDA FSH 2509.22). This handbook provides standard operating procedures for all stream classes. The Tongass Timber Reform Act mandates a minimum 100-foot buffer on all Class I streams and on Class II streams that flow directly into Class I streams. This legal requirement has been incorporated into Riparian Standards and Guidelines for stream process groups found in the TLMP. The width of these buffers may be greater than 100 feet for reasons such as topography, riparian soils, a windfirm boundary, timber stand boundaries, logging system requirements, and varying stream-channel locations. In addition, certain Class III streams flow directly into or have been identified as influencing Class I streams. All Class III stream consist of variable width, standard and guideline side-slope buffers. In all cases, windfirmness was considered and applied accordingly. Split yarding or full suspension was built into the logging and transportation design process, as was partial and full suspension over wetland soils or soils with a higher mass-movement potential. Direct instream impacts are minimized through road construction timing and fish passage requirements on Class I and II streams. Refer to the Sea Level ROD for the unit-specific stream buffering, suspension, passage, and timing requirements being applied. Application of BMPs and riparian standards and guidelines will protect water quality, fish habitat, and wetlands as well as riparian habitat important to other species such as deer, bear, and furbearers.

Wildlife

Mitigation measures to protect wildlife habitat are a part of the design of the alternatives, including the location of the harvest units and roads. Harvest units and roads are intentionally located away from important wildlife habitats (to the extent practicable) to reduce the effects on wildlife. Beach and estuary habitats are completely avoided by harvest units, while road incursions are minimized to the extent practicable. Where possible, disturbance of important travel corridors is minimized to allow the movement of wildlife.

Goshawks

The TLMP contains the following guidelines for preserving habitat around all confirmed and probable nests. These guidelines have been incorporated into the Sea Level Project.

Nesting Habitat

An area will be maintained of not less than 100 acres of productive old-growth forest (if it exists), generally centered over the nest tree or probable nest site. Included are prey-handling areas, perches, roosts, inactive nest stands, hiding cover and foraging opportunities for young

goshawks. Vegetative structure should include a multi-layered, closed (over 60 percent) forest canopy, a relatively open understory, with large trees (usually 20+ inches diameter at breast height) and low ground vegetation. These conditions generally equate to the high timber volume strata used in the TLMP.

Management

No commercial timber harvest is permitted. Existing roads may be maintained. New road construction is permitted if no other reasonable roading alternatives exist outside the mapped nesting habitat. No continuous disturbance likely to result in nest abandonment will be allowed within the surrounding 600 feet from March 15 to August 15. Activity restrictions are removed for active nests that become inactive or are unsuccessful.

All new nests discovered during field reconnaissance or unit layout will be protected from timber harvest and blowdown by implementing the above measures.

Marbled Murrelets

Due to the limited information available on nesting habitat requirements of marbled murrelets, any nests located during field reconnaissance or unit layout will be assessed on a case-by-case basis.

A 600-foot, generally circular radius of undisturbed forest habitat surrounding identified murrelet nests will be maintained. Disturbance activities within this buffer will be minimized during the nesting season (May 1 to August 15). The buffer zone will be maintained and the site monitored for nesting activity for not less than two nesting seasons after nest discovery. The buffer protection may be removed if the site remains inactive for two or more consecutive nesting seasons.

Trumpeter Swans

Timber harvest units that are within a half mile of Gnat Cove estuary and Low Lake will allow harvest and road construction activities from April 1 to October 31. During the remainder of the year, harvest and road construction may occur if swans are not present. This affects the Units 48 and 173.

Bald Eagle Nests

Road construction activities that are within a half mile of bald eagle nests will usually have blasting restricted to the period of September 1 to February 28. If the nest is unoccupied, normal blasting procedures are also permitted from June 1 to August 31, if there is no direct danger to eagles, nests, eagle nest trees, or other eagle habitat elements. Blasting within a half mile of an active eagle nest is only allowed if: (1) the blasting can be accomplished in accordance with the requirements of the Bald Eagle Protection Act, (2) written coordination with the U.S. Fish and Wildlife Service has occurred, and (3) the results of the interagency coordination are documented. Alternative 1 has no harvest units within a half mile of known bald eagle nests. Alternative 5 has 3 units within a half mile of a known eagle nest; Alternative 7 has 10 units within a half mile; and Alternative 2 has 18 units within a half mile of known eagle nests.

The interagency agreement also establishes a 330-foot buffer zone around each nest where disturbance activities are prohibited. None of the alternatives propose harvest within the 330-foot buffer zone.

2 Alternatives

Whale Habitats

The following TLMP standards and guidelines apply to all Forest Service permitted or approved activities:

- Provide for the protection and maintenance of whale habitats.
- Ensure that Forest Service permitted or approved activities are conducted in a manner consistent with the Marine Mammal Protection Act, the Endangered Species Act, and National Marine Fisheries Service regulations for approaching whales, dolphins, and porpoise. "Taking" of whales is prohibited; "taking" includes harassing or pursuing or attempting any such activity.

Marine Mammals

Forest-wide standards and guidelines to provide for protection and maintenance of harbor seal, Steller sea lion, and sea otter habitats are as follow:

1. Ensure that Forest Service permitted or approved activities are conducted in a manner consistent with the Marine Mammal Protection Act and the Endangered Species Act. "Taking" of marine mammals is prohibited; "taking" includes harassment, pursuit, or attempting any such activity.
2. Locate facilities and concentrated human activities requiring Forest Service approval as far from known marine mammal haulouts, rookeries and known concentration areas as practicable. The following distances are provided as general guidelines for maintaining habitats and reducing human disturbance:
 - Facilities, camps, LTFs, campgrounds and other developments should be located one mile from known haulouts and farther if the development is large.
 - Individuals associated with Forest Service permitted or approved activities will not intentionally approach within 100 yards, or otherwise intentionally disturb or displace any hauled-out marine mammal.
 - Dispose of waste oil and fuels off-site as regulated by the Alaska Department of Environmental Conservation.

Several harbor seal haulout areas identified near the Project Area have been listed below.

- Minx Islands and associated rocks in Thorne Arm,
- Snipe Islands and associated rocks in Thorne Arm,
- Rocks off Mop and Pop Points in Thorne Arm, and
- Rocks and islands in Carroll Inlet from Shoal Cove to Hume Island

Waterfowl

Significant waterfowl areas include Gnat Cove estuary, and the estuaries at the head of Thorne Arm. These habitats will be maintained through the protection of the 1,000-foot estuary buffer. Activities are located as far from these areas as feasible. Disturbance to waterfowl will be minimized by the mitigation for protecting trumpeter swans.

Mountain Goat

Aircraft flights, including helicopter yarding of timber, will seek to avoid mountain goat kidding areas from May 15 through June 15. Flights should maintain a 1,500-foot vertical or horizontal distance from traditional summer and kidding areas and animals.

Restrict blasting within 1 mile of known mountain goat kidding areas from May 15 through June 15.

Subsistence

Because most subsistence use involves harvesting fish and game, mitigation measures that protect fish and game resources also protect subsistence activities. By placing units and roads away from beach- and estuary-fringe habitats, and away from salmon-bearing streams, mitigation measures were built into each of the alternatives considered in the EIS. Road management objectives (closures) were also heavily influenced by the desire of subsistence hunters to limit access.

Recreation

Effects of timber harvest on views from anchorages and known recreational day-use areas will be reduced by leaving buffers of timber along the beaches and inland lakes. The proposed VQOs for this Project emphasize the protection of the visual resource as viewed from saltwater, particularly in Carroll Inlet and Thorne Arm. Protecting these viewsheds will reduce the direct effects on visual quality. Stream riparian buffers will protect fisheries habitat in the Project Area.

Cultural Resources

Potential effects on cultural resources can be minimized by excluding Project activities from most high-probability areas (exceptions are LTFs, camps, a small number of units, and access roads to these facilities). The high-probability areas were all surveyed in 1994 and 1995, except for exact road locations which cannot be precisely determined until after unit and road layout occurs. Types of mitigation measures include, avoidance, protective enclosures, monitoring of harvest activities, restrictions on size or road location, and recovery and documentation of materials.

Sensitive Plants

Choris Bog Orchid (*Platanthera chorisana*) is a designated sensitive species. Six populations of this species were discovered in muskeg openings during botanical surveys of the Project Area conducted in 1995. Populations are located within the vicinity of Units 2 and 80 in the Shoal Cove area, Units 126 and 134 in the Sea Level Creek drainage and along Road #8341160 of the Shelter Cove road system. The primary risk of perturbation to these populations would be through road construction activities. Road locations have been adjusted to avoid direct impacts to known locations of Choris Bog Orchid.

Monitoring

Monitoring is divided into three broad categories: TLMP monitoring, routine implementation monitoring, and project-specific effectiveness monitoring. These are discussed in the following sections.

TLMP Monitoring

Three levels of monitoring are incorporated into the TLMP monitoring and evaluation plan (TLMP, Chapter 6).

1. Implementation Monitoring is used to determine if standards and guidelines, and management prescriptions are implemented as detailed in the TLMP and project specifications.
2. Effectiveness Monitoring is used to determine if standards and guidelines, and management prescriptions, as designed and implemented, are effective in meeting TLMP goals and objectives.
3. Validation Monitoring is used to determine whether the data, assumptions, and coefficients used in the development of the Plan are correct.

2 Alternatives

Mitigation/ Monitoring Feedback Loop

Most monitoring elements involve the mitigation measures described previously. The feedback provided by monitoring can be used to develop improved methods or additional treatments to ensure that the mitigation will be effective in the future.

An annual monitoring report is prepared by the Tongass National Forest at the end of each year. This report addresses all monitoring questions contained in the TLMP, references monitoring being conducted on the Forest, assesses progress toward achieving the goals and objectives described in the TLMP, and certifies that the TLMP is sufficient to guide management of the Forest over the next year or proposes needed changes and an approach for dealing with those changes.

Some TLMP monitoring is conducted over the entire Forest on a sample basis. Samples may or may not be taken within the Sea Level Project Area. Other monitoring, particularly implementation monitoring, is conducted on all projects. A total of 36 implementation, effectiveness, and validation monitoring items are identified in the Forest monitoring plan.

In 1996 the Forest Service and the Department of Environmental Conservation entered a Memorandum of Agreement that establishes an Interagency Monitoring and Evaluation Group (IMEG). The IMEG evaluates the implementation monitoring while Forestry Sciences Laboratory in cooperation with the Forest Service conducts effectiveness and validation monitoring. Effectiveness monitoring requires more intensive sampling over longer periods of time, which translates to research. The 1997 IMEG Report lists the effectiveness monitoring occurring on the Tongass National Forest.

Implementation Monitoring

Implementation monitoring assesses whether the project was implemented as designed and whether or not it complies with the TLMP. Planning for routine implementation monitoring began with the preliminary design of harvest units and roads. Specialists used on-the-ground inventories, computer inventories, and aerial photographs to prepare unit cards for each harvest unit. Cards were also prepared for each segment of road. Resource specialists wrote their concerns on the cards and described how the concerns should be addressed in the design of each unit and road segment. The unit and road cards are the basis for determining whether recommendations were implemented during the Sea Level Project.

Implementation monitoring is part of the administration of a timber-sale contract. The sale administrators and road inspectors ensure that the prescriptions contained on the unit and road cards are incorporated into contract documents and then monitor performance relative to contract requirements. Input by resource staff specialists, fisheries biologists, soil scientists, hydrologists, and engineers is regularly requested during implementation to provide technical advice when questions arise.

The Tongass National Forest conducts reviews of BMP (and other standard and guideline) implementation and effectiveness. The results are summarized in the Tongass National Forest Annual Monitoring and Evaluation Report. This report provides the public with information about how management direction of the Forest is being carried out.

Project Specific Monitoring

Project-Specific Monitoring

In addition to TLMP implementation monitoring, Project-specific effectiveness monitoring activities are identified. Effectiveness monitoring seeks answers about the effectiveness of design features or mitigation measures in protecting natural resources.

Sensitive Species

Choris Bog Orchid

Objective—To provide protection of specific habitats for this species which is located in the Sea Level Project Area.

Desired Result—Minimal site disturbance to populations of Choris Bog Orchid. Populations are located within the vicinity of Units 2 and 80 in the Shoal Cove area, Unit 126 and 134 in the Sea Level Creek drainage and along Road #8341160 of the Shelter Cove road system.

Measurement—Protect known locations during sale implementation.

Threshold—Visual inspection of site indicates signs of disturbance or reduced vigor.

Corrective Action—Consult with Area Threatened and Endangered Species coordinator.

Responsible Staff—Ketchikan Ranger District/Misty Fiords National Monument Staff timber/silviculture staff.

Record of Results—Daily diaries used for contract administration. Prepare a brief report of results each year.

Annual Cost—On-going business for timber/silviculture

Trumpeter Swan

Objective—Protect wintering Trumpeter swans.

Desired Results—Preferred swan wintering areas in Gnat Cove and Low Lake will be protected from disturbance.

Measurement—Visual observation of wintering swans at least once when any timber harvest or road construction occurs within a half mile of Gnat Cove estuary or Low Lake between November 1 and April 1.

Threshold—Evidence that swans are avoiding available habitat because of Forest management activities.

Corrective Action—Consult Ketchikan District Ranger and Supervisor's Office wildlife staff if a conflict arises.

Responsible Staff—Ketchikan Ranger District sale administration employees and wildlife staff.

Record of Results—Sale administrator may record swan observations in daily diary forms. Wildlife specialists will prepare a short memo.

Annual Cost—Ongoing business for sale administrator and wildlife specialist.

Validation Monitoring

Validation monitoring is conducted to show if the assumptions or models used in planning are correct. It is usually carried out at the Regional level in conjunction with research. Validation monitoring may or may not occur within the Sea Level Project Area since this type of monitoring is built into a Forest-wide Action Plan.

2 Alternatives





U.S.D.A. Forest Service

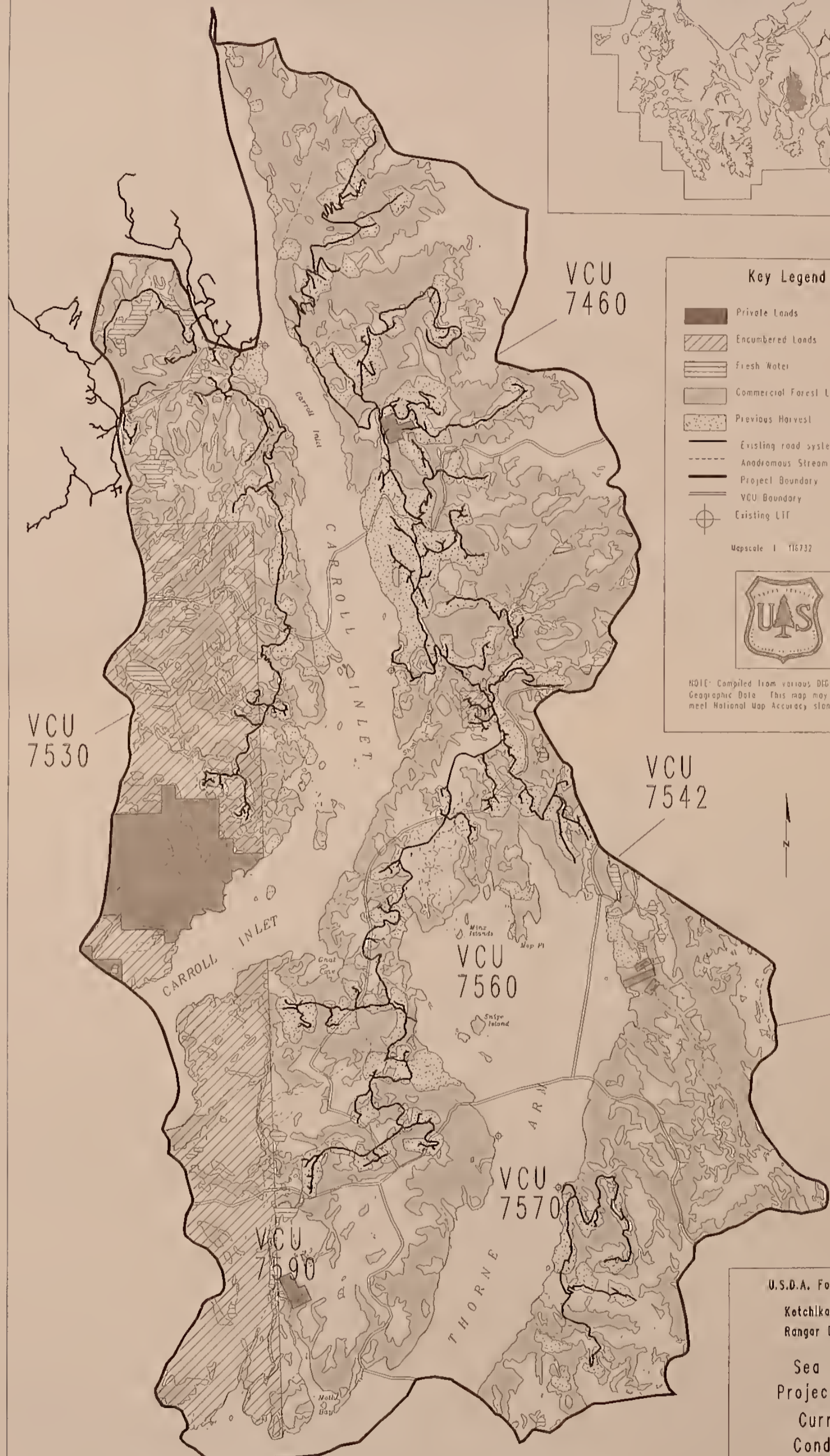
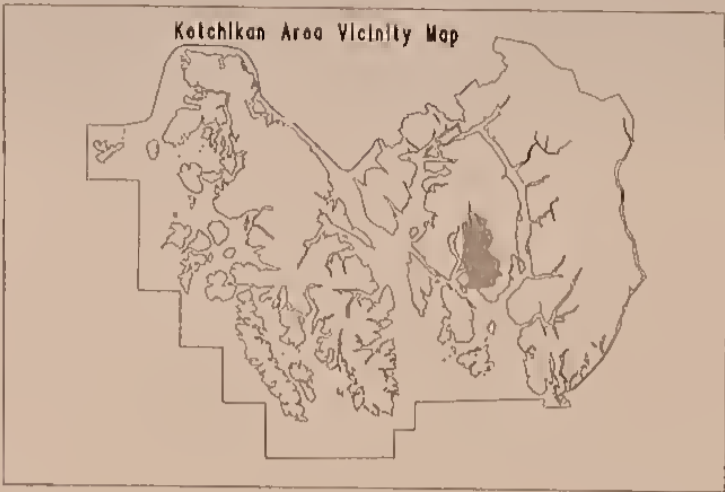
Ketchikan-Misty
Ranger District

Sea Level
Project Area
Current
Condition

December 1997

1.84 0.0 1.84 3.68 5.53 7.37 Miles

Scale is 1 Inch = 1.84 Miles



Key Legend

- Private Lands
- Encumbered Lands
- Fresh Water
- Commercial Forest Lands
- Previous Harvest
- Existing road system
- Anadromous Stream
- Project Boundary
- VCU Boundary
- Existing LIT

Mapscale 1:116,732

NOTE: Compiled from various DIGITAL Geographic Data. This map may not meet National Map Accuracy standards.

U.S.D.A. Forest Service
Ketchikan-Misty
Ranger District

Sea Level
Project Area
Current
Condition

December 1997

1.84 0.0 1.84 3.68 5.53 7.37 Miles

Scale is 1 Inch = 1.84 Miles



Ketchikan Area Vicinity Map



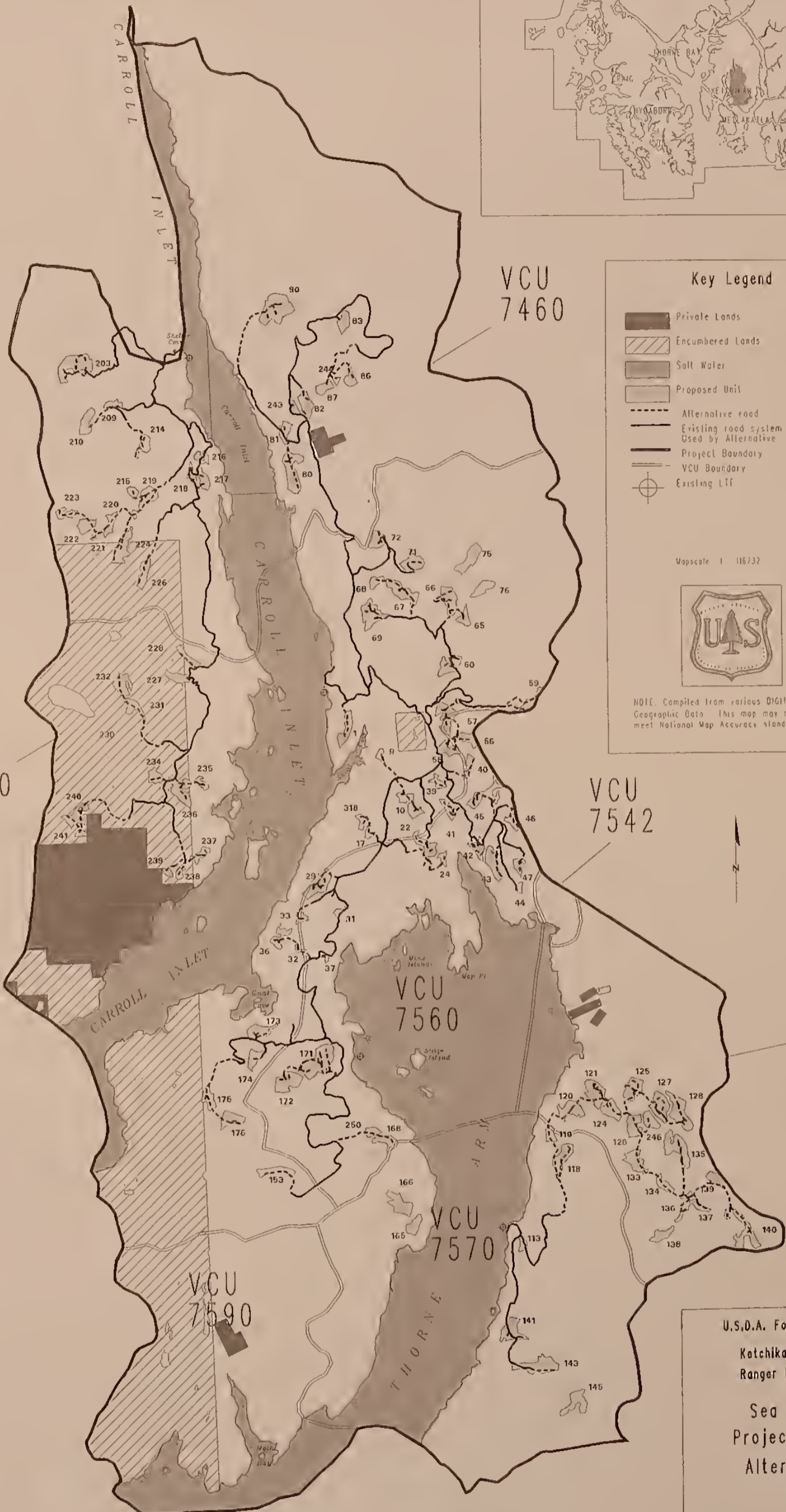
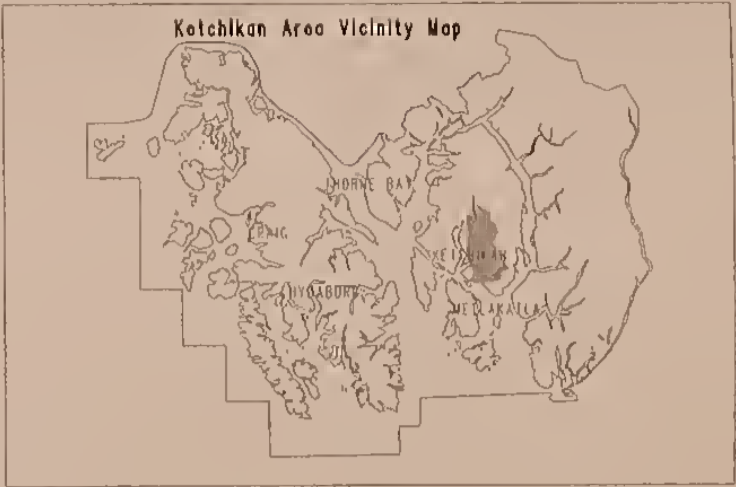
U.S.D.A. Forest Service
Ketchikan-Misty
Ranger District
Sea Level
Project Area
Alternative
2

December 1998



Scale is 1 Inch = 1.84 Miles





Key Legend

- Private Lands
- Encumbered Lands
- Salt Water
- Proposed Unit
- Alternative road
- Existing road system Used by Alternative
- Project Boundary
- VCU Boundary
- Existing LTI

Mapscale 1:116732



NOTE: Compiled from various DIGITAL Geographic Data. This map may not meet National Map Accuracy Standards.

U.S.D.A. Forest Service

Ketchikan-Misty
Ranger District

Sea Level
Project Area
Alternative
2

December 1998

Ketchikan Area Vicinity Map

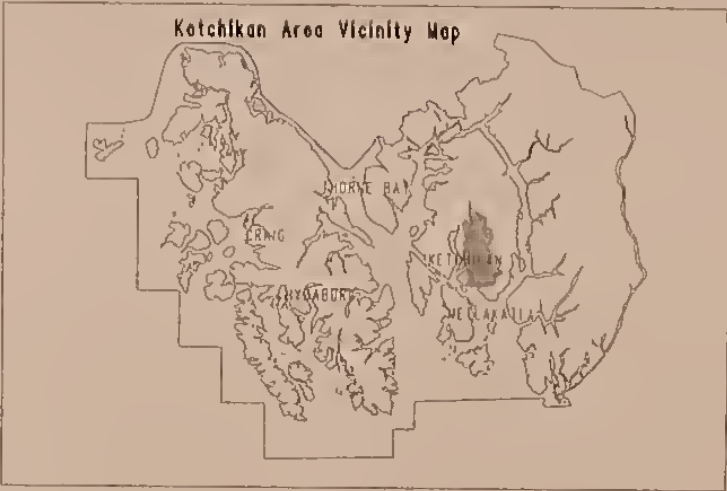


U.S.D.A. Forest Service
Ketchikan-Misty
Ranger District
Sea Level
Project Area
Alternative 5

December 1998



Scale is 1 Inch = 1.84 Miles

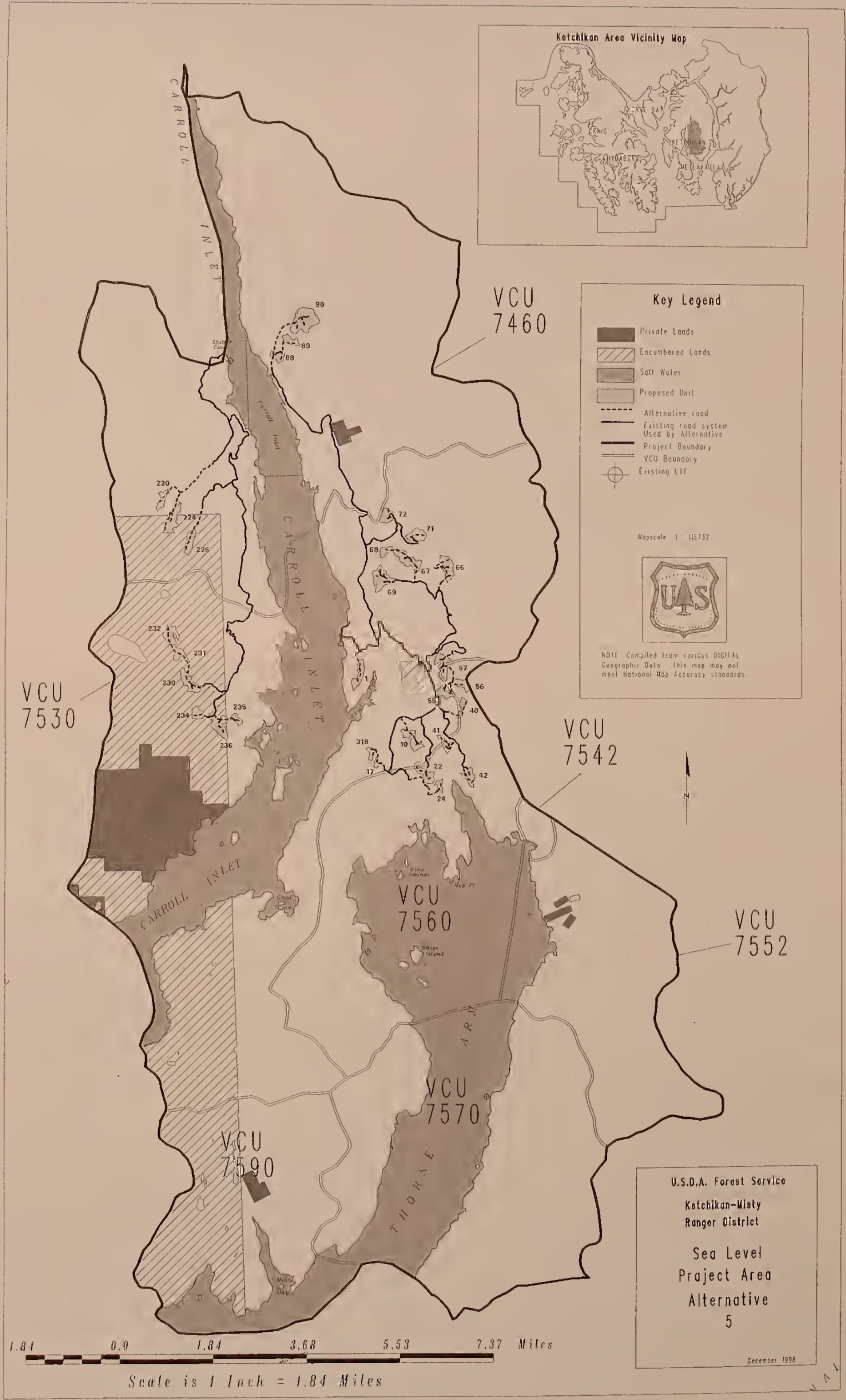


Key Legend

- Private Lands
- Encumbered Lands
- Salt Water
- Proposed Unit
- Alternative road
- Existing road system
- Used by Alternative
- Project Boundary
- VCU Boundary
- Existing LIF

Mapscale 1:115,732

NOTE: Compiled from various DIGITAL Geographic Data. This map may not meet National Map Accuracy standards.



U.S.D.A. Forest Service
Ketchikan-Misty
Ranger District
Sea Level
Project Area
Alternative
5
December 1998

Ketchikan Area Vicinity Map



U.S.D.A. Forest Service

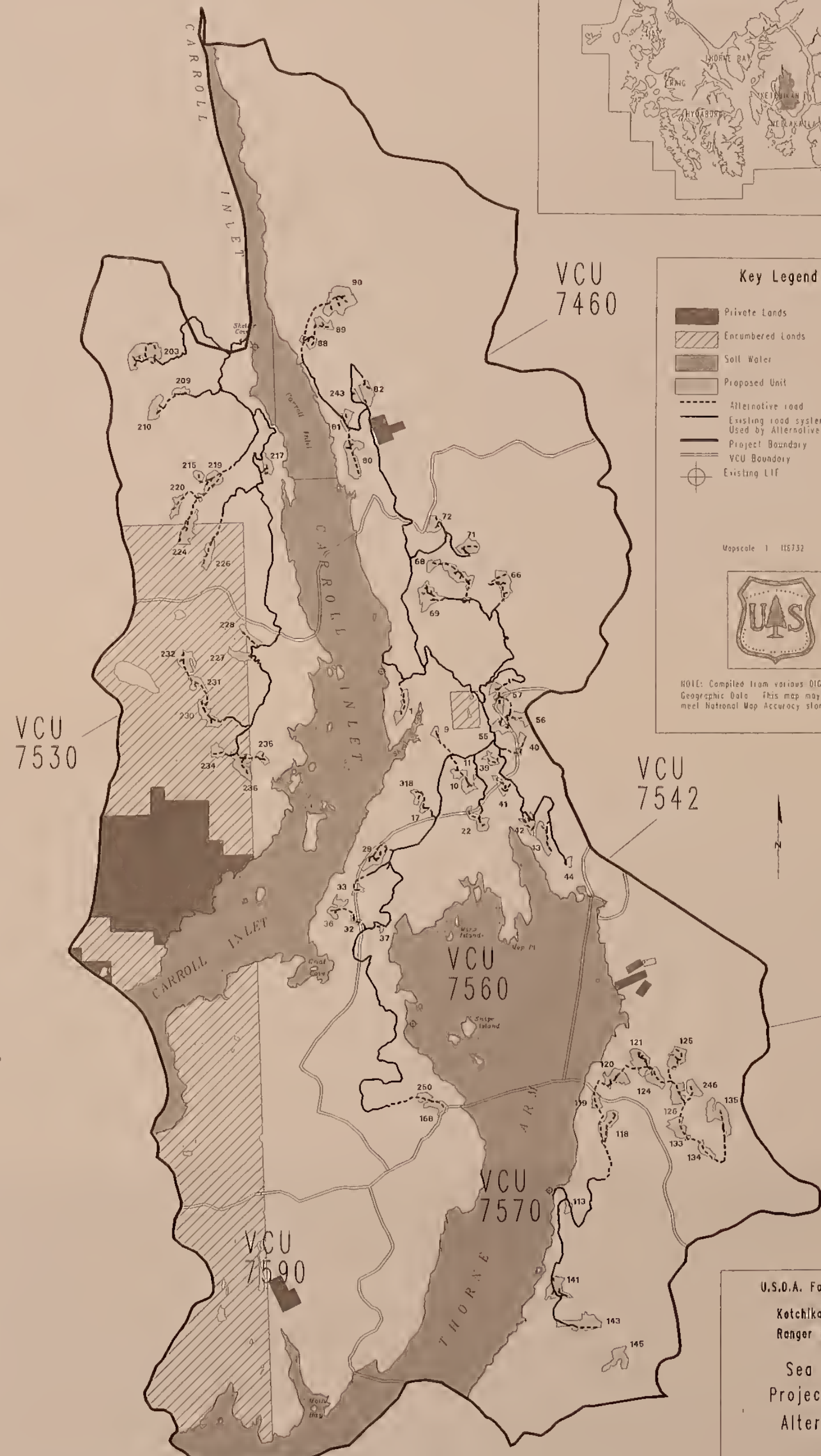
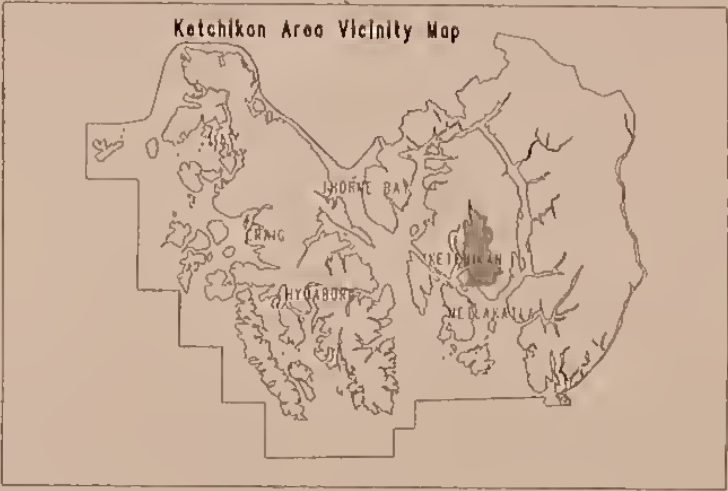
Ketchikan-Misty
Ranger District

Sea Level
Project Area
Alternative
7

December 1998



Scale is 1 Inch = 1.84 Miles

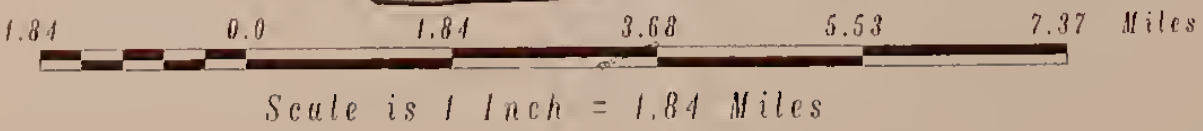


Key Legend

- Private Lands
- Encumbered Lands
- Soil Water
- Proposed Unit
- Alternative road
- Existing road system Used by Alternative
- Project Boundary
- VCU Boundary
- Existing LIF

Mapscale 1:116,732

NOTE: Compiled from various DIGITAL Geographic Data. This map may not meet National Map Accuracy standards.



U.S.D.A. Forest Service
Ketchikan-Winty
Ranger District
Sea Level
Project Area
Alternative
7
December 1998



Chapter 3

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Chapter 3

Affected Environment and Effects of the Alternatives

Introduction

This chapter presents information about those aspects of the environment that may be affected by the activities in the proposed alternatives. The "Affected Environment" portion of each resource section describes the current condition of the resource, trends related to its status, and relevant characteristics that may be subjected to impacts from the alternatives. The "Effects of the Alternatives" portion of each section presents the direct, indirect, and cumulative effects (or impacts) of activities under the alternatives. Chapter 3 combines into a single chapter information that in many Environmental Impact Statements (EISs) appears in separate chapters (generally called Chapter 3 "Affected Environment" and Chapter 4 "Environmental Consequences"). This chapter provides the basis for the comparison of the alternatives in Chapter 2.

Available Information

There is less than complete knowledge about many of the relationships and conditions of wildlife, fish, forests, jobs, and communities. The ecology, inventory, and management of a large forest area is a complex and developing science. The biology of wildlife species prompts questions about population dynamics and habitat relationships. The interaction of resource supply, the economy, and communities is the subject matter of an inexact science.

The interdisciplinary team (IDT) examined the data and interrelationships used to estimate the effects of the alternatives. The data and level of analysis used were commensurate with the importance of the possible impacts. Relevant discussion in the Tongass Land Management Plan (TLMP) is incorporated by reference.

When encountering information gaps, the IDT concluded that obtaining the missing information may have added precision to estimates or better defined relationships. However, the basic data and central relationships are sufficiently well established in the respective sciences and additional information would be unlikely to reverse or nullify understood relationships. While additional information would be welcomed and may add precision, it is not essential to a reasoned choice among the alternatives as they are constituted.

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Analyzing Effects

Effects are quantified where possible, although qualitative discussions are also included. The means by which any identified potential adverse effects will be reduced or mitigated are described in detail in Chapter Two.

Environmental consequences are the effects of implementing an alternative on the physical, biological, social, and economic environment. Direct environmental effects are defined as those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity but would be significant in the foreseeable future. Cumulative effects result from the incremental effects of actions when added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

The reasonably foreseeable time frame over which both direct and indirect effects are estimated is through the end of a 10-year planning period in the year 2007. Alternative 2 is used to display the reasonably foreseeable future actions, as this is the maximum harvest alternative, within Forest Plan standards and guidelines. Volume not harvested in other action alternatives could be harvested as part of another project by the year 2007.

The cumulative effects are also projected for various resources up to the year 2054 and 2140. The year 2054 is the year by which most areas within land use designations (LUDs) permitting timber harvest will be converted from old-growth to second-growth timber management. The year 2140 is when the Forest Plan estimates the management emphasis or desired future condition will be reached. The cumulative effects analysis in this document tiers to the TLMP. It also considers the 10-year timber sale action plan referenced in Appendix A which is used to project the volume range to be harvested in each operating period. As a result, the cumulative effects do not depend entirely on the alternatives presented in this EIS. Rather, they include what may be expected under the direction detailed in the TLMP. The decisions made in the Forest Plan provide long-range direction for management of the Tongass National Forest for the duration of the Forest Plan. Cumulative effects analyzed in this EIS include both the effects of this Project and those projected by the TLMP Final EIS (1997), which are incorporated by reference.

The following assumptions were made to assess the reasonably foreseeable effects to the year 2007. These assumptions reflect current management and technology of national forests and provide a uniform approach to estimating effects of timber harvest and road construction.

- Laws, standards, guidelines, and Best Management Practices (BMPs) for water quality would be followed. These requirements are expected to be at least as much protection in the future as they do today.
- Timber sale planning would use an interdisciplinary process.
- All acres of suitable land, as identified in the TLMP (1997), would be equally subject to impacts.
- The no-action alternative would represent only a delay in implementing the TLMP Final EIS and, based on volume projections in the 10 year timber sale action plan, foreseeable cumulative effects would begin to occur before 2007.
- Future effects on resources from timber harvest and road construction would be similar to impacts projected for current alternatives.

Potential adverse environmental effects which cannot be avoided are discussed. Unavoidable adverse effects may result from managing the land for one resource at the expense of the use or condition of other resources. Many adverse effects can be reduced or mitigated by limiting the extent or duration of effects. Mitigation measures to be implemented, including standards

and guidelines, are specified for project activities under the alternatives. These are discussed briefly throughout the chapter, and in detail in Chapter Two.

- *Short-term effects* are those that occur annually or within the first 10 years of project implementation.
- *Long-term productivity* refers to the capability of the land and resources to continue producing goods and services for 50 years and beyond.
- *Irreversible commitments* are decisions affecting non-renewable resources such as soils, minerals, plant and animal species, and cultural resources. Such commitments of resources are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or the resource has been destroyed or removed. For example, a rock pit which is used to provide rock to build roads throughout the Project Area would be considered an irreversible commitment of the resource.
- *Irretrievable commitments* represent opportunities foregone for the period during which resource use or production cannot be realized. These decisions are reversible, but the production opportunities foregone are irretrievable. An example of such commitments is the allocation of LUDs that do not allow timber harvest in areas containing suitable and accessible timber lands, a decision that is made at the Forest Plan level. For the time over which such allocations are made, the opportunity to produce timber from those areas is foregone, thus irretrievable.



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Land Divisions

The land area of the Tongass National Forest has been divided in several different ways to describe the different resources and allow analysis of how they may be affected by Forest Plan and project level decisions. These divisions vary by resource since the relationship of each resource to geographic conditions and zones also varies. Three of these are used for more than one resource and are described briefly here.

Ecological Provinces

The Tongass National Forest identifies 21 large land areas that are distinguished by differences in ecological processes (TLMP Final EIS, Chapter 3, Biodiversity). They are defined by a combination of climatic and geographic features. The Sea Level Project Area lies within the Revilla Island/Cleveland Peninsula ecological province (Number 15) and is discussed in the Biological Diversity and Wildlife sections of this chapter.

Value Comparison Units (VCUs)

These are distinct geographic areas, each encompassing a drainage basin containing one or more large stream systems. The boundaries usually follow major watershed divides. The Tongass contains 867 VCUs; three are found in the Sea Level Project Area. They are used to describe the locations of specific resources in the Project Area. VCUs 737, 744, and 746 are within the Sea Level Project Area.

Wildlife Analysis Areas (WAAs)

These are Forest Service land divisions that correspond to Minor Harvest Areas used by the Alaska Department of Fish and Game. Approximately 190 apply to the Tongass National Forest, two of which apply to the Sea Level Project Area. They are used in the Subsistence and Wildlife sections. Portions of WAAs 406 and 510 are included within the Sea Level Project Area.



Description of the Ecosystem

Project Area

The Sea Level Project Area lies entirely within the Revillagigedo (Revilla) Island/Cleveland Peninsula ecological province. This province includes Revillagigedo, Annette, Duke, and Gravina Islands and the Cleveland Peninsula south and west of Eagle Lake. This province is a combination of climatic and geographic features. The Revilla Island/Cleveland Peninsula Ecological Province includes 1,174,000 acres. This province contains 526,226 acres of productive old growth. Approximately six percent of the available old growth has been harvested since 1954.

The Cleveland Peninsula portion of the province is a part of the mainland of Southeast Alaska's panhandle region. The remainder of the ecological province is made up of Revillagigedo Island.

The Project Area is mountainous, often rising abruptly from sea level to several thousand feet. Elevations of forested areas extend up to approximately 2,200 feet in the Project Area.

Abiotic Components

The configuration of the coastline, the warm Japanese ocean current, and the high coastal mountains produce abundant rainfall. Storms and moderate to heavy precipitation occur year round, but most commonly from September through November. The abundant moisture feeds numerous streams, rivers, and lakes.

The Sea Level Project Area has a maritime climate, resulting from the moderating influence of the Pacific Ocean. In the summer, this provides a cooling influence, while in winter, temperatures are warmer than would be expected for these latitudes. Normal temperatures range from the mid-40s to the mid-60s in the summer, and from the high teens to the low 40s in the winter. During the warmer months, temperatures are highest inland and lowest along the coasts, while in the colder months, the reverse is true.

The Sea Level Project Area has complete cloud cover about 85 percent of the year. October is generally the wettest month. High precipitation persists through the middle of November when intermittent snowfall occurs. Snowfall varies according to elevation and distance inland from the coast. Snow accumulation below 500 feet elevation is short-lived, generally melting within a few days due to warmer temperatures and rain.

The climate has a significant influence on the ecology of Revilla Island. Moderate temperatures and ample precipitation produce good growing conditions for commercial forest species. These factors also slow rates of decomposition, resulting in the characteristic buildup of organic material on the forest floor. Storms produce winds in excess of 80 knots and heavy precipitation occurs from September through December. Wind generated by these storms is a significant factor in the development of forest stands. Blowdown ranging from a few trees to several hundred acres may occur. Blowdown accompanied by heavy precipitation and saturation of the soil may trigger landslides in forested areas. Windthrow is further discussed in the Silviculture section of Chapter 3.

Biotic Components

The coastal forest of the Revilla Island/Cleveland Peninsula Ecological Province is part of the cool, temperate rainforest that extends along the Pacific coast from southern British Columbia to Prince William Sound. Most of the forest is composed of old-growth conifers, primarily western hemlock and Sitka spruce, with mountain hemlock, western redcedar and Alaska yellowcedar as other major components. Red alder is common along streams, beach fringes, and on sites recently disturbed by logging and landslides. Subalpine fir occurs occasionally at tree line.

Blueberries, huckleberry, Sitka alder, devil's club, and salal are common shrubs in the forest. Plant growth on the forest floor includes deerheart, dwarf dogwood, single delight, and skunk

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cabbage. Mosses grow in great profusion on the ground, on fallen logs, on the lower branches of trees, and in forest openings.

Grass-sedge meadows usually are located along lakes and major streams. Interspersed throughout the forest are muskegs dominated by sphagnum mosses and sedges.

The alpine zone usually lies above 2,500 feet. It occupies the area above the coastal forest and is separated from the forest by a subalpine or transition zone. Alpine plants have adapted to snowpack and wind abrasion by evolving low-profile growth forms. Low, mat-forming vegetation covers most alpine areas, with cushion-like plants occupying crevices on rock outcrops and talus slopes.

The forests, shorelines, streams, and rivers of Southeast Alaska provide habitat for over 350 species of birds and mammals, including both nongame animals and animals such as black bear, Sitka black-tailed deer, moose, wolf, mountain goat, beaver, otter and marten. Many of these are found in the project area. The coastline provides an ideal habitat for a large population of bald eagles, and wetlands provide nesting habitat for waterfowl.

A highly productive marine environment includes an abundance of marine mammals, halibut, herring, and shellfish. Both resident and anadromous fish are found within and adjacent to the project area, including five species of Pacific salmon, Dolly Varden char, cutthroat trout, and steelhead trout.

Site-specific information on biological resources in the Project Area follows in various sections of this chapter.



Air Quality

Key Terms

Ambient air—the air, external to a building, encompassing or surrounding a specific region.

Ambient air-quality standard—the prescribed level of pollutants in the outside air that cannot be exceeded legally during a specified time in a specified geographical area.

Class I Airshed—one of three classes of areas provided for in the Clean Air Act for the Prevention of Significant Deterioration program. Class I Airsheds are the "cleanest" and receive special visibility protection.

Class II Airshed—the second of three classes of areas provided for in the Clean Air Act. Class II Airsheds have no specific attainment criteria.

Prevention of Significant Deterioration (PSD)—a program established by the Clean Air Act to protect ambient air qualities and air-quality-related values.

Affected Environment

Although there is little scientific information on the baseline air quality of the Sea Level Project Area, the air quality of the region is generally good. Exchange of air typically comes from relatively pollution-free air off the Gulf of Alaska. Vehicles and home heating, particularly wood-fired heating, contribute to regional particulate matter concentrations. Local sources of airborne particulates include motor vehicle emissions, dust, residential and commercial heating sources in the Ketchikan Gateway Borough population center, marine traffic on Tongass Narrows, George Inlet, Carroll Inlet and Thorne Arm, the Ketchikan Pulp Company sawmill at Ward Cove, the Seley sawmill on Gravina island, and a limited amount of open burning.

Alaska has experienced localized problems with wood smoke and has issued regulations that limit open burning and other air-pollution-generating activities in wood smoke control areas between November 1 and March 31. The wood smoke control areas do not include the Project Area. Open burning may be restricted in the Project Area when an air-quality advisory is issued by the Alaska Department of Environmental Conservation (ADEC) (AAC 50.030). The ADEC has the primary responsibility for attainment and maintenance of Ambient Air Quality Standards under the provisions of the Clean Air Act (see the TLMP 1997 for related air-quality discussion). The Forest Service cooperates with the ADEC to protect air quality on National Forests in Alaska. The entire Project Area is a Class II Airshed for purposes of Prevention of Significant Deterioration (PSD) and does not have specific attainment criteria under the Clean Air Act. There are no Class I Airsheds designated in Southeast Alaska, which is a more restrictive requirement.

Effects of the Alternatives

Direct, Indirect and Cumulative Effects

There is currently little information on the possible effects of ambient air-quality on forest resources in Southeast Alaska. Forest health monitoring recently initiated under a National resource program includes air-resource-related parameters. Methods of conducting

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inventories are being developed to address this information need. Baseline resource conditions are being monitored on the Forest at this time.

National Ambient Air Quality Standards (NAAQS) for indicators of particulate matter less than 10 microns (PM10) in size are established by the Federal Environmental Protection Agency (EPA). These are established as the concentration limits to protect against adverse effects on public health and welfare. The PM10 indicators are utilized because the human respiratory system cannot efficiently filter out particulate matter this size or smaller. Wildfires and prescribed fires can be a source of fugitive particulate matter less than 10 microns in size.

Prevention of Significant Deterioration of ambient air quality is a program established by the Clean Air Act to:

- Protect public health and welfare from any actual or potential adverse effects from air pollutants not withstanding attainment and maintenance of all National ambient air-quality standards.
- Ensure economic growth will occur in a manner consistent with the preservation of existing clean-air resources.
- Preserve air quality and air-quality-related values in areas of special National or regional natural, recreational, scenic, or historic values.
- Ensure that any decision to permit increased air pollution is made only after there has been adequate opportunity for informed public participation in the decision-making process and after evaluation of all consequences.

The NAAQS for particulate matter less than 10 microns in size would not be violated by the proposed action. Prevention of Significant Deterioration indicators in the Southeast Alaska Intrastate Air Quality Control Region, for sulphur dioxide, oxides of nitrogen, and total suspended particulate, have not yet been triggered, making an analysis unnecessary.

All of the action alternatives are expected to have limited, short-term impact on the ambient air quality. Alternative 1, the no-action alternative, would result in the least emission of particulate and gaseous air pollutants in the near term. The potential for uncontrolled forest fires would be slightly higher for the action alternatives because of the logging slash created. The occurrence of wildfire, even when logging slash is present, is uncommon in Southeast Alaska due to the amount of precipitation received throughout the year.

Effects on Air Quality Outside the Project Area

The action alternatives may result in a continued supply of raw wood products to area sawmills near Ketchikan. This may indirectly affect air quality at the KPC's mill at Ward Cove, Alaska. Processing of timber harvested from the Project Area would result in emissions into the air and may affect air quality.

The KPC operates a sawmill in Ward Cove near the city of Ketchikan, Alaska. As part of a request by the ADEC and as part of the KPC's most recent air quality permit to operate, the KPC submitted a dispersion modeling assessment to address the ambient impacts of various mill emissions. By the consent decree, the KPC also agreed to conduct ambient air-quality monitoring for PM10 at a minimum of two locations near the mill if required as a result of the ambient impact assessment. The ambient impact assessment is also an important component for siting the ambient air-quality monitors, if necessary, for an air-quality network.

For further information on the effect of the KPC's operations on air quality at Ward Cove and the EPA's permitting process, contact the EPA Region 10 Office in Seattle, Washington, or the ADEC offices in Ketchikan or Juneau, Alaska.

Aquatic Resources

Key Terms

Adfluvial—species or populations of fish that do not go to sea, but live in lakes and enter streams to spawn.

Best Management Practices (BMPs)—practices used for the protection and maintenance of water quality.

Interagency Monitoring and Evaluation Group (IMEG)—group formed to monitor and evaluate implementation and effectiveness of Forest Plan standards and guidelines.

Large Woody Debris (LWD)—stable woody material in a stream channel.

Potential Impact Index (PII)—risk index based on proposed management activities within a watershed.

Riparian Management Area (RMA)—the area including water, land, and plants adjacent to perennial streams, lakes and other bodies of water that is managed for the inherent qualities of the riparian ecosystem.

Sediment Risk Index (SRI)—a hydrological risk index based on sediment storage and transport potential.

Affected Environment

Fish Species

Project Area streams support four species of salmon (pink, chum, coho, and king), as well as cutthroat trout, rainbow/steelhead trout, and Dolly Varden char. These species are the most important to the commercial, recreational, and subsistence fisheries of the region and are a major food resource for many wildlife species. The Tongass Land Management Plan and the Sea Level Project use coho and pink salmon as the Management Indicator Species (MIS) for anadromous fish to represent two different phases of salmon life history: spawning/egg incubation and freshwater rearing. Dolly Varden char and cutthroat trout were selected to represent resident species.

The Alaska Department of Fish and Game (ADF&G) does not list sockeye or king salmon in the Project Area. In 1991 fish habitat survey crews observed an adult king salmon in Gunsight Creek. This was probably a stray fish from the terminal fishery at the head of Carroll Inlet. Both cutthroat trout and Dolly Varden char may be present in their anadromous forms or as resident populations in lakes and reaches of streams not generally used by anadromous species. There have been no recorded introductions of resident or anadromous fish in the Project Area. There are no threatened and endangered fish species within the Project Area.

Fish Habitat Capabilities and Requirements

Channel Types and Process Groups

Stream channel types provide a system to estimate the amount and quality of fish habitat within the Project Area. The Sea Level Project Area contains a variety of channel types, mostly in the Palustrine, Floodplain, Moderate Gradient Mixed Control, Large Contained, Moderate Gradient Contained, and High Gradient Contained Process Groups. Short stretches of the Estuarine and Alluvial Fan Process Groups are also included. Process groups describe the interrelationship between watershed runoff, landform relief, geology, and glacial or tidal influences on fluvial erosion or depositional processes. Process groups are used for assigning

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riparian standards and guidelines. Riparian standard and guidelines serve to maintain existing habitat conditions where land disturbing management activities occur.

Habitat Capability

Fish habitat capability models were run to estimate potential fish production. Channel types provide a means for estimating fish production based on channel type production coefficients. The Project Area contains 16 different channel types. Two high gradient contained channels, HC5 and HC6, considered less productive and not normally fish habitat, were not included in the estimates. The Project Area contains two channel types that produce the most fish, broad valley bottom floodplains, (FP4), and palustrine channels influenced by beaver activity, (PA5). Project Area FP4 and PA5 channel types alone are estimated to produce approximately 18,000 Dolly Varden with 14,000 of that production coming from beaver pond channel type. The other 12 channel types, combined, estimate production of approximately 9,000 Dolly Varden.

The capability models tend to overestimate production for coho and pink salmon because of flaws in the model (see *Fisheries Resource Report* for details). In the past, these models were used to estimate changes to production based on amount of harvest within 100 feet of fish bearing streams. Because all fish streams receive minimum 100 foot buffers, the model no longer serves this purpose. The ADF&G conducts annual aerial and foot surveys on selected streams in the Project Area. The Department aggregates surveys of many streams to indicate overall salmon escapement for large geographic areas rather than to identify escapement for any given stream. Aerial surveys have not been consistently collected in the Project Area. Coho and pink salmon population data for the Project Area does not exist. Protocols for determining trends in populations and habitat for resident Dolly Varden Char, cutthroat trout, and coho salmon are presently being developed for future use as directed by Chapter Six of the Forest Plan.

Stream Value Class

A classification primarily associated with fish use determines stream value. Stream classes describe values, such as whether anadromous or resident fish inhabit a particular stream. Class I contains anadromous, adfluvial, or high value resident fish habitat, Class II contains resident fish habitat, and Class III and Class IV contain no fish habitat but contribute to down stream productivity. The Project Area contains 151 miles of Class I stream, 144 miles of Class II stream, 208 miles of Class III stream, and 13 miles of Class IV stream currently mapped in GIS. Biologists continuously update the GIS streams coverages based on site specific information. The incidence of Class III and IV streams in GIS increases in areas where we actively manage for timber production. The increase reflects the higher intensity of site specific information collected in harvest units because smaller and well forested Class III or IV streams typically will not show up on aerial photos or topographical maps.

Large Woody Debris

In streams, Large Woody Debris (LWD) influences a wide array of abiotic features as well as biotic community structure and function (Harmon et. al. 1986). LWD provides complexity to the habitat, dissipates stream energy, forms pools, provides nutrients to primary and secondary producers, and functions to store sediment. LWD also provides cover from larger predators. Prior to the enactment of Tongass Timber Reform Act (TTRA), timber often was harvested to the edge of the streams, and stream cleaning operations were commonly conducted to prevent perceived fish passage problems. Past management practices have reduced the future recruitment potential of LWD in some fish streams within the Project Area. In other fish streams, harvest increased the amount of LWD within the channels with excessive slash. The excessive slash occurred as a result of cut trees falling or washing into the stream. Stream surveys identified the occurrence of excessive slash on several watersheds

within the Project Area. These watersheds are listed on Table 3 of the *Fisheries Resource Report* which is part of the planning record.

Blowdown of Trees

Blowdown can contribute to the LWD needed to maintain and enhance in-stream habitat. Natural factors and shape of harvest units determine the probability of blowdown occurring in adjacent stands (Harris 1989; Moore 1977). Many streams within the Project Area contain blowdown of trees where past harvest practices left narrow buffers (buffers less than 100 feet). These blown down trees now function as LWD and in most cases increase habitat complexity. In watersheds such as Gnat Creek (EY3A), the blowdown resulted in excessive slash in the streams, causing temporary migration barriers to anadromous fish. Beavers often take advantage of the blowdown to dam streams. This opportunistic behavior is apparent by the beaver dams within the Minx Flat portion of the Project Area.

Intertidal Zone

The lower reaches of larger streams in the Project Area, including reaches within the intertidal zone (ITZ), contain the bulk of existing spawning habitat for pink and chum salmon. In the Project Area, major estuaries are located at Shoal Cove, Gnat Cove, Sea Level Creek, and at the unnamed stream located south of Buckhorn Creek. Additional small estuaries are found at the outlet of smaller stream systems throughout the Project Area, especially at the northern portion of the Thorne Arm.

Stream Restoration Plans

As per BMP 12.3 *Watershed Improvement Planning and Implementation*, Stream Restoration plans located in Appendix E identify objectives and cost estimates of stream restoration. Table 3 of the *Fisheries Resource Report* lists four categories of restoration: (1) RMA vegetation manipulation (thinning) where past harvest occurred to the stream bank; (2) Slash manipulation in streams where slash causes migration barriers or channel widening; (3) Bank stabilization where erosion causes excessive sediment input to the stream; and (4) Instream structure where surveys identified structure as a limiting factor of quality habitat. Analysis of Project Area stream surveys indicate that approximately 6,000 meters of Class I and II stream contains segments where slash removal or RMA vegetation manipulation should occur.

The streams fall primarily in ten watersheds in three VCU's: 7560, 7530, and 7460. This condition does not occur as a result of timber harvest or blowdown on the west side of Carroll Inlet (Shelter Cove Sale Areas) or on the east side of Thorne Arm, Elf Point to Fish Creek. The stream surveys analysis identified only a few instances where LWD or instream structure was a limiting factor for quality fish habitat. The road condition surveys are located in the Planning Record. The surveys identified maintenance and stream crossing concerns and restoration needs; see also Chapter Three *Roads and Facilities*.

Uses of Water

Consumptive Uses

Key consumptive water uses within the Project Area include:

- U.S. Coast Guard Loran facility at Shoal Cove uses surface water for domestic water supply;
- U.S. Forest Service Administrative Site at Shoal Cove uses surface water; U.S. Forest Service Recreation Cabin--Fish Creek uses surface water sources; and
- Although there are currently no logging operations that require camps in the Project Area, logging operators use surface water for domestic water supply.

There are no congressionally designated municipal watersheds within the Project Area.

Beneficial Uses

The waters of the area are an important source of habitat for resident and anadromous fish and other aquatic life. Additional beneficial uses of the waters of the study area include

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stream channel maintenance, dispersed recreation use, terrestrial wildlife habitat (*see Sea Level Wildlife Resource Report*), and subsistence harvest.

The Project Area contains a variety of freshwater resources which can be characterized with respect to their hydrology, water quality, and consumptive water uses. The beneficial uses of water quality on National Forest lands are primarily quality fish and wildlife habitat. The EPA's Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in The Pacific Northwest and Alaska says that fish habitat is an indicator of water quality where the beneficial use of the waters is indeed fish habitat (MacDonald 1991). Chemical water column parameters have limited usefulness for monitoring most management activities in forest areas. (McDonald 1991). Road building and maintenance and forest harvest have the greatest influence on the increased sediment load and the reduction in the riparian vegetation. These changes can adversely impact most of the usual physical and chemical water quality constituents, but with the exception of temperature these effects are generally small or indirect (McDonald 1991). Water quality characteristics are discussed below and correspond to the key water quality parameters identified in the State of Alaska and EPA water quality criteria for maintaining natural productivity of aquatic organisms.

Hydrology

The yearly runoff cycle follows seasonal variations in temperature, rainfall, and snowmelt. Fish Creek, located in Thorne Arm, generally portrays the annual water discharge cycle representative of streams in the Project Area. Fish Creek has two low-flow and two high-flow periods. In March, average monthly discharge drops to about 258 cubic feet per second (cfs) because of cold temperatures and minimal snowmelt. In late May to early June, average discharge increases to about 507cfs as spring precipitation changes to rain, and snowmelt occurs. During the summer, precipitation decreases and evapotranspiration increases; consequently, stream discharge drops to an average monthly value of 326 cfs in August. In autumn, average river discharge rises with the increased rainfall and reaches a peak of almost 700 cfs in October.

Stream Temperature

Frequent cloud cover, low air temperatures, steep channel gradients, abundant precipitation, and snow melt runoff through most of the summer keep stream temperatures below the range considered harmful to aquatic organisms in the Project Area. High stream temperatures have been associated with decreased oxygen content and adult salmon fish kills in Southeast Alaska. In 1995 biologists walked streams on the District to investigate rate of fish kills due to extended high temperatures and low flows in the Area. Biologists found fish kills on pristine streams of Cleveland Peninsula, Black Bear Creek and Wasta Creek as well as on managed systems, Margaret Creek. No fish kills due to temperature have been documented in the Project Area.

In 1995, North Revilla project area monitoring sites were established at Klam Creek and Traitors Creek watersheds (USDA 1995h). The data show some stream temperatures exceed 15° Celsius for extended periods, temperature considered potentially detrimental to fish survival and propagation. On Klam Creek, temperatures on the harvested portion of the fish stream, A Frame Logged from Klu Bay in 1955, exceeded 15° Celsius, in the months of June through August (USDA 1995h). This low gradient floodplain channel runs west to east and contains no standing timber on the southern aspect of the stream. Potential future monitoring considerations are to include ambient temperature data. No ambient temperatures were recorded in this study.

Dissolved Oxygen

Dissolved oxygen content in most streams, and lakes in Southeast Alaska are usually at or near saturation due to self-aeration in the turbulent, high-gradient streams. In quiet waters,

lakes, and wetlands dissolved oxygen content may drop below saturation. Muskeg streams in the Project Area typically are slightly acidic (pH 6.5). Although water in Southeast Alaska is never completely free of organic and inorganic matter, chemical water quality is high. Concentration of total dissolved solids are typically less than 150 ppm.

Stream Sediment

Natural and Management Disturbances

Because of heavy rainfall and stream geomorphology, streams of Southeast Alaska in general are sediment poor. Steep terrain and heavy rainfall are factors which contribute to natural sediment production. Swanston (1989) indicated that about 3 percent of all major landslides directly affect fish-bearing streams. Active natural streambank erosion is obvious on Painted Creek. Volcanic ash in the stream banks and bed of Painted Creek are a significant natural source of sediment. Refer to the soils section for detailed discussions of landslides and sediment (pages 3-36 and 3-37). Blowdown is another common disturbance within the Project Area. See discussion of blowdown in *Fish Habitat Requirements* section above.

Major sources of management-induced sediment in the area result from: (1) road construction activities, (2) road use and maintenance, and to a lesser degree (3) logging activities. Research indicates that there are no statistically significant changes in suspended sediment average values before and after logging (Meehan et al. 1969; Beschita 1986, Lloyd et al. 1987). Research by Paustian (1987) indicates that natural suspended sediment concentrations in watersheds in Southeast Alaska are typically low. Sediment production and delivery to streams is roughly proportional to the amount of road constructed, slope gradient, soil type, the amount of use, the number of stream crossings, the proximity of the road to the stream, area of timber harvested, yarding system used, and the amount of naturally produced sediment. Road condition surveys have identified potential road induced sediment sources in the Project Area. Additional information can be found in the Roads and Facilities section and Appendix D.

Sediment Risk Assessments: Delivery and Deposition

In order to place the Project Area watersheds into a landscape perspective, the Forest Service ran the landscape level (SRA) model to compare Revillagigedo Island's 405 watersheds for sediment delivery and deposition potential. Eighteen of the Project Area watersheds ranked within the top 10 percent of the island SRA for existing condition. Painted Creek ranked the highest for both sediment delivery and deposition, setting the SRI scale at 100 for Revilla Island watersheds. The Forest Service then ran the landscape level SRA model on 91 watersheds in the Project Area. Only 50 watersheds contain proposed activity. The model develops sediment transport and deposition indices, based upon watershed morphology, discharge, and potential sediment sources. The *Fisheries Resource Report* provides a comprehensive investigation of the watersheds where management activity is proposed. This information is another tool in alternative analysis to identify proposed road locations, unit locations, unit design, and areas to avoid.

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Riparian Management Areas

To comply with BMP 12.6 *Riparian Area Designation and Protection*, field data from the Basin Wide Surveys (BWS), soils surveys, and vegetation inventories were used to develop Project Area RMAs. The RMAs provided another tool to identify harvest units that would most likely have potential adverse affects to fisheries habitat (BMP 13.1 *Timber Sale Planning* and BMP 13.2 *Timber Harvest Unit Design*). This RMA assessment helped formulate alternatives and identify units with potential to adversely affect fish habitat. In some cases units were adjusted to avoid areas of concern. These areas were "deferred" from the unit which means that they are not considered suitable for timber production due to wildlife resource or other concerns mentioned in this paragraph. Other units were dropped from any alternative altogether.

Individual unit cards show the RMAs for all stream classes.

Major Watersheds

Ten watersheds in the Project Area are greater than 5 square miles in size. These watersheds have the greatest potential for contributing to the recreational or commercial fisheries. The watersheds are: Licking Creek, Calamity Creek, Marble Creek, and Saddle Lakes located in VCU 7460; Easy Creek, Painted Creek, Spit Creek, and Buckhorn Creek located in VCU 7530; Sea Level Creek located in VCU 7550; and Fish Creek located in VCU 7540. Sea Level Creek and Painted Creek watersheds are the only two fish-producing watersheds that contain more than three true sub-watersheds and more than two miles of anadromous fish habitat within the Project Area. Sea Level Creek and Painted Creek are analyzed for geomorphic risk at the watershed level. The Watershed Report of the *Fisheries Resource Report* contains watershed analysis that meets the site-specific requirements set forth by Appendix J of the Forest Plan for Painted Creek (E76A) and Sea Level Creek (E79A). The Saddle Lakes watershed contains 484 acres of lake habitat that may eventually be road-accessible from Ketchikan. Fish Creek, Spit Creek, and Sea Level Creek provide excellent steelhead and salmon fishing opportunities.

Environmental Consequences

Timber harvest activities have the potential to affect aquatic resources by altering fish habitat as a result of upstream activities. The alteration may have some positive as well as negative effects. The positive effects would be recharge of sediment and LWD into the stream. Logging and associated road building can affect fisheries resources by changing the delivery of water, sediment, and organic debris into the stream system. Changes of the input and transport of these components can adversely affect the capability of the stream habitat to produce fish. The closer the timber harvest activities are to a stream, the higher the risk of adversely affecting fish habitat.

Fish Habitat Protection Standards

The National Forest Management Act prohibits any activities near streams which would seriously and adversely affect fish habitat (36 CFR 219.27 (e)). In addition, the Tongass Timber Reform Act of 1990 requires a no-harvest buffer zone of at least 100 feet on each side of all Class I streams, and all Class II streams that flow directly into Class I streams (section 103 (a)). Finally, the Best Management Practices (BMPs) FSH 2509.22, designed to ensure compliance with the Clean Water Act, help protect riparian habitat on streams or portions not protected by buffer zones. Application of BMPs minimize detrimental effects to soil and water resources. BMPs contain categories that pertain directly to streams: (1) directional felling of trees and bucking and limbing of logs within streams and buffer zones; (2) yarding of logs across streams and buffers by either cable or tractor methods; (3) treatment of solid and slash logs deposited in stream channels; (4) prevention of erosion during tractor logging on hillslopes, including construction and maintenance of skid trails; (5) mechanical site preparation in buffer zones for replanting; and (6) road design, construction, maintenance, and obliteration. BMPs are applied as a system of practices rather than a single practice. In order to minimize the potential for adverse impacts on soil and water resources by management activities, BMPs are used to directly or indirectly protect water quality from nonpoint source pollution. This is done through site-specific prescriptions.

The Forest Plan Riparian Standards and Guidelines incorporate this direction and provide additional protections. The Riparian Standards and Guidelines require no-harvest buffers along all Class I, II and III streams, based on stream process groups and a defined RMA as stated previously, and provide guidelines for management beyond the no-harvest zone to provide for a reasonable assurance of windfirmness. The Riparian Standards and Guidelines and other direction of the Forest Plan meet or exceed all of the recommendations made by the Anadromous Fish Habitat Assessment. The Riparian Standard and Guidelines will be applied in all watersheds on the Project Area, and are sufficient to protect fish habitat and provide for sport and commercial fisheries and subsistence. No reductions to RMA buffers are proposed except in Unit 133 of Sea Level Creek E79A03. A site-specific watershed analysis for Sea Level Creek E79A (which meets the requirements set forth by Appendix J of the Forest Plan) can be found in the Planning Record and in Appendix 2 of the Record of Decision. Use of the measures just discussed all serve to substantially minimize potential effects to the Project Area aquatic resources. Measurable direct, indirect or cumulative effects to fisheries resources are not anticipated. See Water Quality and Monitoring Feedback Loops later in this section for further discussion about effectiveness monitoring for this project.

Operations in RMA

In compliance with BMP 12.6a, *Buffer Zone Design and Layout*, factors affecting blowdown will be refined during field layout of the units to reduce blowdown hazard. There may be occasion where individual trees are cut within the RMA to access timber on the other side of a buffer or for cable tail holds on the other side or within a buffer. Any trees fallen within the RMA will be fallen in accordance with BMP 13.16 Stream Channel Protection. This would

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occur only after completion of a streamcourse protection plan by a District Fisheries Biologist.

Water yield responses to timber harvest activities have received little study in Southeast Alaska's watersheds. There were no observed changes in stream flow measured in the Maybeso watershed (Prince of Wales Island) following clear-cutting of 25 percent of the drainage basin (Meehan et al. 1969). An analysis of Staney Creek drainage basin, also on Prince of Wales Island, following harvest of 35 percent of the watershed did show significant increases in summer low flows (Bartos 1989).

Several variables (elevation, aspect, basin geomorphology, soils, vegetation, geology, snow storage, and precipitation patterns, cutting unit size, distribution of units within the watershed, and scheduling of harvest entries) could influence stream runoff. BMPs applied in the Project Area (see Appendix 1 and 2 of the ROD, for site-specific application for each unit and road) would reduce the potential for changes in streamflow regimes. The average harvest unit size for this project ranges from 24.2 acres in Alternative 2 to 17.7 acres in Alternative 7. All Class I, II, and III streams received windfirm buffers to reduce temperature increase and reduce evapotranspiration to stream corridor. Buffers on Moderate Gradient Mixed Control (MM) and Floodplain process groups exceed the minimum 100-foot TTRA buffer widths and in some cases exceed Forest Plan standard and guideline buffers by 200 percent. The contained process groups are not as likely to meander before, during, or after harvest as the FP and MM process groups.

Effects of Alternatives

Table Aquatic-1 displays the acres of harvest and miles of road to be constructed for the ten major watersheds. Alternative 2 proposes the most harvest at 2,857 acres with 51 miles of new road construction across 44 watersheds. Alternative 5 harvests 867 acres and proposes 17 miles of new road construction across 16 watersheds. Alternative 7 harvests 1,828 acres with 30 miles of new road construction across 35 watersheds. The acres of harvest listed do not include deferral acres. Deferral selection considers resource protection with the intent of meeting or exceeding all Forest Plan standard and guidelines. The deferral areas are considered unsuitable for timber production now or in the future. Alternative 2 includes 1,391 acres of deferral, Alternative 5 includes 406 acres of deferral, and Alternative 7 includes 1,006 acres of deferral. See Timber section for more information about deferral vs. partial cut and clearcut.

Table Aquatic-1
Major Watersheds

Watershed Name	Minor Code	Area (mi ²)	Alternative 2 Harvest & New Road		Alternative 5 Harvest & New Road		Alternative 7 Harvest & New Road	
			Acres	Miles	Acres	Miles	Acres	Miles
Buckhorn Creek	E50A	5.3	82	1.4	93	1.1	124	1.4
Calamity Creek	I14A	6.6	122	3.7	84	1.1	84	1.1
Easy Creek	D96A	6.0	48	0.1	48	0.1	48	0.1
Fish Creek	D97A	33.3 ¹	0	0.0	0	0.0	0	0.0
Licking Creek	D91A	6.4	0	0.0	0	0.0	0	0.0
Marble Creek	D87A	5.8	122	2.5	0	0.0	76	0.7
Painted Peak	E76A	10.9	402 ³	2.5	316 ⁵	1.5	316 ⁵	1.5
Saddle Lakes	D79A	9.2	174	4.1	14	0.6	123	3.1
Sea Level Creek	E79A	20.1 ²	428 ⁴	11.3	0	0.0	159	7.4
Spit Creek	E42A	8.0	120	2.8	0	0.0	0	0.0

¹ Value reflects mi² of actual watershed size, watershed within project boundary is only 0.5 mi²

² Value reflects mi² of actual watershed size, watershed within project boundary is only 9.5 mi²

³ Includes 111 acres of partial cut.

⁴ Includes 17 acres of partial cut.

⁵ Includes 84 acres of partial cut.

BMP 12.9 Identification and Avoidance of Unstable Areas

Due to the location of proposed units immediately adjacent to anadromous fish habitat, the Licking Creek watershed will be deferred from timber harvest during this entry. More than 40 percent of Licking Creek contains slopes greater than 75 percent with 65 percent of its soil coded as high or very high mass movement index.

Harvest in Spit Creek watershed is avoided in Alternatives 5 and 7. Fish survey information suggests that Spit Creek watershed contains a significant amount of high quality fish habitat. Alternative 2 limits harvest to the east side of the drainage (units 175 and 176) and avoids all components of the RMA. Fish Creek is also deferred from timber harvest or new road

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construction in all alternatives. Painted Creek watershed contained road construction to Unit 66 which posed potential adverse effects to fish habitat. This unit will be helicopter yarded.

The following units from Alternative 2 display characteristics of increased potential for impacts to beneficial uses: E76A Units 65, 75, 76; E79A04 Unit 128; D79A 221, 222, and 223; D87A Units 86 and 244; I14A Unit 83. The preceding units are not included in Alternative 7. BMP 13.9 *Determining Guidelines for Yarding* has been applied to mitigate the potential effects to the beneficial uses and can be found on individual unit cards with appropriate yarding prescription.

Following the Draft EIS, further site specific analysis reveals that new road locations do not display characteristics that would adversely affect fish habitat or water quality of Gunsight Creek watershed (D86A).

BMP 14.7 Measures to Minimize Mass Failures.

Alternative 7 avoids construction of approximately five miles of new road. Table Aquatic-2 displays the number of Class I, II, and III stream crossings for each alternative preceded by a brief discussion. The five miles of new road would access Units 66, 86, 87, 135, and 244. Resource protection measures such as a bridge requirement to cross an anadromous fish stream near Unit 66 make new road construction uneconomical. Also new road construction in Units 66, 86, 87, and 244 require resource protection measures that would make road construction difficult and expensive. Unit 135 will also likely be helicopter yarded. These areas are not considered unsuitable for timber production or road construction.

Water Temperature and Dissolved Oxygen

By leaving a Riparian Management Area (RMA) along streams, no thermal increases are expected in Class I, II, and III streams.

Stream Sediment

Swanston's (1989) Tongass landslide survey categorized 23 percent of all landslides as debris torrents that occur in deeply cut V-notch gullies. Based on Swanston's results, there is about a one-in-four chance that any management-related landslide will have an impact on Class I streams and only a very slight chance that impacts on fish habitat could occur. It can be inferred that the majority of these landslides would affect primarily Class III stream channels, since only about 3 percent of all natural and management-induced slide events in this survey were shown to directly affect Class I streams. Approximately one debris slide, 5 acres or larger, occurs for every 2,240 of harvested acres Forest-wide (TLMP 1997). If slides smaller than 5 acres are included, then the number of debris slides occurring for every 2,240 harvested acres would increase 150 percent. The average size of a slide on the Ketchikan Area is 5 acres (Loggy 1974). Approximately 867 to 2,857 acres are proposed for harvest. This would equate to 0.39 to 1.28 slides associated with harvest. At 5 acres per slide, this would equate to 1.95 to 6.4 acres of soil disturbance that would need stabilizing and rehabilitation. Sale Area Improvements include slide stabilization where the objective is to stabilize, rehabilitate and monitor management induced landslides (see the Watershed Report in the Sea Level Planning Record).

Care should be taken in extrapolating these results to the Project Area. Changes in road construction and harvesting technology, as well as greater sensitivity to water quality and fish habitat concerns (as reflected in the BMPs, for example, and much improved soil and water inventory information), have resulted in more effective management practices for timber operations in landslide-prone areas. These factors will tend to reduce management-related landslide incidences in the Project Area from the rate observed by Swanston. The State of Alaska will grant a short-term variance from anti-degradation requirements or water quality criteria for a one-time, temporary activity, such as the installation of a road crossing, that is a non-point source of sediment, and for a temporary activity associated with the placement of

fill material affecting a specific water body. Specific activities of this nature are identified in the unit and road cards in Appendix 1 and 2 of the Record of Decision (ROD).

Natural and management-induced stream bank erosion was recorded during basin-wide stream surveys in the Project Area. Painted Creek (E76A) showed a high degree of natural erosion especially in Guadalupe Creek (E76A05). The high occurrence was probably due to the erosion properties inherent with volcanic cinder that occurs there. No signs of excessive sediment or loss of fish habitat were observed in the stream channel. Road condition surveys identified a potential management induced sediment source in Painted Creek sub-watershed E76A03. The 8440 road crosses a high energy, (HC6) Class III stream that is causing road prism failure. Basically, during very high flows the water is scouring the road. Road reconstruction plans will apply recommendations to correct the potential sediment source. Basin-wide stream surveys in the composite sub-watershed below the said crossing show no signs of excessive sediment. A beaver pond lies approximately 500 meters downstream from the potential sediment source. As with any dam, sediment will be stored behind the dam complex.

Consumptive Water Use

The USCG is the only consumptive water user within the Project Area. Because the USCG Loran station sits on headwaters of a Painted Creek sub basin, their water quality should not be affected by timber harvest or road construction. The application of BMPs will maintain water quality for all consumptive uses stated previously.

Road Management Considerations

BMP 14.6 Timing Restrictions for Construction Activities

BMP 14.6 provides direction concerning instream operations. Instream construction activities in Class I streams are restricted to periods when fish eggs or alevin are not in the gravels as established by the timing window, generally during summer months. The timing windows for instream construction can vary slightly from stream to stream. To reduce the direct and indirect effects to fish habitat, site specific fisheries and field information including ADF&G recommendations are used to determine the operating windows and will be applied to the Project Area. In the Ketchikan Area, the instream operating windows are generally established to be June 1 to August 7 for pink and chum salmon, June 15 to September 1 for coho salmon, and July 18 to August 7 for steelhead trout. Site-specific information on timing restrictions may be found in the road cards in Appendix 2 of the ROD.

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Stream Crossings

Table Aquatic-2 displays the number of crossings for each stream class. The *Fisheries Resource Report* contains the information for each road. Two of the five Class I crossings listed in Alternative 2 access Units 127 and 128 in the Sea Level Watershed, and two others access Units 66 and 65 in the Painted Creek Watershed (E76A). Road 843082 contains one Class I crossing identified in Alternative 5 and 7. Road 843082 provides access to Unit 29 located in the Myops Watershed (E73A), Minx Flat VCU.

Table Aquatic-2
Number of Road Crossings in Each Alternative

Stream Class	Alternative 2	Alternative 5	Alternative 7
Class I	5	1	1
Class II	17	9	13
Class III	29	10	19

Source Sainz 1998.

Four Class II streams occur on Road 8445 that access Unit 90 in un-named watershed I13A, Carroll Inlet VCU. Every effort to relocate the road to avoid the four crossings is planned during Project implementation.

Site surveys and Recommendations

The Project applied a road condition survey protocol based on the Stikine Area format and modified by the Ketchikan Area and ADEC personnel. The surveys resulted in recommendations for corrections to stream crossings through road maintenance in the Sea Level Project Area. With site specific information available on existing roads, critical stream crossings and roads that are potential sediment sources can be effectively managed. Three recommendations were applied for each alternative, including the No Action alternative:

- Repair, remove, or replace stream crossing structures identified on existing roads as malfunctioning;
- Apply BMPs to improve crossings of Class III, or IV streams, and road drainage ditches identified as potential or existing sediment sources; and
- Re-contour slopes where roads have either failed or will not need to remain open and pose a potential landslide or sediment source.

In addition to road condition surveys implemented on existing roads, fisheries personnel field reviewed and made recommendations to be applied on all proposed roads.

Cumulative Watershed Effects

The Direct and Indirect Cumulative Effects analysis found in the TLMP Final EIS (page 3-56) judged that watersheds already heavily disturbed by previous management would not be recovered in 100 years, and that current practices (pre-Forest Plan) would continue to degrade some habitats. A Fish/Riparian Panel was completed in 1995 where the TLMP panelists assumed that greater numbers of roads would be located in higher elevations on less stable terrain and harvest would occur on less stable areas when compared to historical harvest and road construction. All panelists agreed that if this scenario were true, then the result would be a greater likelihood of hillslope failure, erosion of fine sediment from road surfaces, and capture and rerouting of natural drainage.

Fifty-nine watersheds within the Project Area contain either existing roads or timber harvest. This project maximizes the use of existing roads to access the harvest units. Five of the seven Project Area VCUs contain proposed management activity. VCU 7542 Fish Creek and VCU 7590 Moth Bay do not have proposed management activity. The VCUs within the Project Area range in size from 0.6 square miles to 63 square miles. To address cumulative effect concerns, measures to avoid additional impacts to aquatic resources in the Project Area include:

- Unit design included consideration for proximity of streams to units, placement of buffers on all Class III streams that might contribute excessive sediment to fish streams, and access from existing road system.
- Implementation of standards and guidelines and other protective measures stated previously reduce the potential for adverse effects.
- Because approximately 50 percent of the total unit acreage consists of deferral acreage or partial cuts unit design can change within those acres to accommodate resource protection.

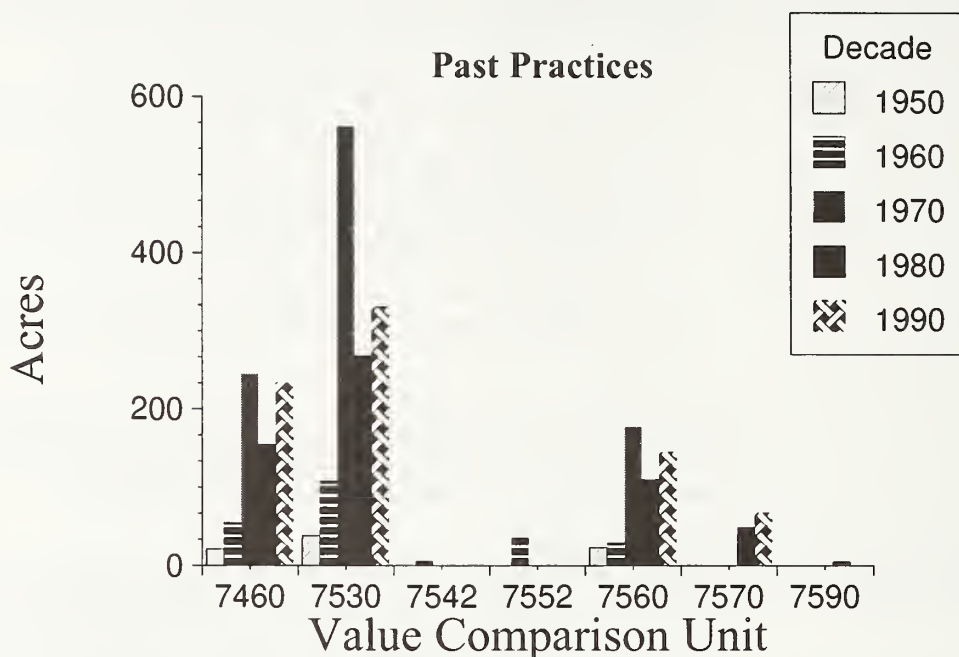
Examples where clearcut and patch cut were adjusted to decrease adverse cumulative effects can be seen on unit cards where computer generated RMA is shaded and actual buffer or deferral area exceeds the computer generated RMA. The application of these measures should allow recovery before the next individual practices.

Riparian Harvest

Prior to implementation of TTRA some harvest was allowed within Riparian Management Areas. Figure Aquatic -1 shows that the distribution of acres harvested is relative to size of VCU. Acres of RMA harvested includes Class I, II, and III streams. VCU 7530 received the most RMA harvest at approximately 560 acres. Most of this harvest occurred during the 1970s in basically three watersheds: Painted Creek (E76A), Easy Creek (D96A), and Marble Creek (I14A). Current RMA Standard and Guideline buffers maintain the functions of RMAs. This project avoids Class I, II, and III RMA and there will be no increase of RMA harvest with the exception of unit 133 in Sea Level Creek. Re-entry into the most heavily affected watersheds was minimized and headwaters with potential to adversely affect downstream habitat are avoided in Alternative 7.

As per BMP 12.3, this project includes stream restoration plans identified during Basin-Wide Stream Surveys. The stream restoration plans are briefly discussed later in the Stream Restoration and Rehabilitation Opportunities section.

Figure Aquatic-1
Riparian Management Area Harvest History Since 1950



GIS 97: J. Llanos, R. Sainz

Sediment Risk Assessments: Delivery and Deposition

Fifty-nine watersheds within the Project Area contain either existing roads or timber harvest. Twenty-six watersheds have over 20 percent of the acres harvested or roaded within the last 30 years. Of 26 watersheds that show very high management percentage, only six are greater than 2 square miles. Watersheds E47A and E45A (private lands rather than National Forest System lands) contain over 65 percent of the watersheds as harvested or roaded. Areas of high risk were avoided. Painted Creek watershed (E76A) rated the highest risk watershed for sediment delivery and deposition. Within Painted Creek watershed, 84 acres scheduled for harvest as part of the Brand X timber sale. Harvest for the Brand X sale may occur concurrently with the Sea Level entry. The streams in the Brand X units were surveyed by Forest Service biologists as part of the interdisciplinary team process. Analyses identified sensitive areas within the Painted Creek watershed. Analyses conclude that the areas of the Painted Creek watershed proposed for harvest can be harvested with no loss to existing fish habitat.

Table Watershed-1 of the Watershed Report (found in the Planning Record) displays the relative watershed ratings, or overall concern, in terms of the eight core topics outlined in the Tongass National Forest Watershed Analysis Handbook. The table is designed to display what the concerns might be for each watershed within the Project Area. Mass slope/erosion (potential for landslides), hydrology, stream channel, human uses (timber harvest and roads), and vegetation are assessed using the Sediment Risk Assessment (SRA) models. The cumulative score is expressed as low, medium, or high in the SRI column. Species and

habitat are based on the amount of habitat available to anadromous or resident fish. There are essentially three consumptive human uses within the Project Area: Timber, commercial, recreational, and subsistence hunting, and fishing. The sport or subsistence fishery scores are subjective ratings based on local knowledge of existing use. Because terrestrial wildlife species are not restricted to habitats within watershed boundaries, hunting is addressed in other sections of this EIS (see Wildlife, Subsistence, and Recreation sections in Volume I). Level of human disturbance is the amount of watershed that is harvested or roaded. The overall concern is a cumulative score of the preceding issues.

Monitoring

While the Interagency Monitoring and Evaluation Group (IMEG), formed per direction in the TLMP ROD, evaluates BMP implementation and effectiveness monitoring, the Forestry Sciences Laboratory, in cooperation with Tongass National Forest personnel, conducts effectiveness and validation monitoring. Effectiveness monitoring requires more intensive sampling over longer periods of time which translates to research. The 1997 Tongass Monitoring Report (in press) lists the effectiveness monitoring occurring on the Tongass National Forest.

Implementation Monitoring

Implementation monitoring will occur on all roads and harvest units in the Project Area. Project roads and harvest units are subject to follow-up implementation monitoring by the IMEG as part of the Tongass Forest Plan monitoring strategy. The 1996 Tongass National Forest Monitoring and Evaluation Report shows that the monitoring group found 100 percent implementation of BMP 13.16 Stream Channel Protection (does not include buffered streams monitored under 12.6 and 12.6a) on the Ketchikan Area. The monitoring group found 97.5 percent success rate on directional falling trees away from streamcourse on approximately 7 miles of stream. No resource damage was noted by the group. The group found 100 percent success rate on split yarding on approximately 5 miles of stream surveyed and 100 percent success rate of debris removal from approximately 8 miles of stream surveyed. These results indicate that implementation of BMPs will prevent measurable effects on chemical water quality or aquatic productivity as the result of timber harvesting in the Sea Level Project Area.

Effectiveness Monitoring

One aspect of monitoring is to determine how changes can be detected. The Ketchikan Area Monitoring Report for 1997 (USDA in press) says that the Sea Level Timber Sale and one other project provide the first opportunity to monitor effectiveness of current Forest Plan Standard and Guidelines.

Painted Creek (E76A) is currently established as a stream subject to channel condition assessments (CCA) studies. Painted Creek represents a managed watershed and contains three CCA sites. This initial study has shown differences in channels of managed and un-managed watersheds. The current effort is directed at use of the assessment methodology as a monitoring tool. Painted Creek meets many, if not all of the criteria needed to monitor and evaluate effectiveness of current riparian standards and guidelines. Fish counts at CCA sites were conducted in 1997 by both FSL and Area fisheries personnel (USDA unpublished). Painted Creek will also be subject to buffer stability and effectiveness monitoring. The evaluation criteria outlined for all effectiveness monitoring in the Monitoring Guidebook (USDA 1998a). Because Painted Creek meets all of the evaluation criteria this framework will allow for the interpretation of measured change or lack of change in the context of processes and conditions occurring throughout the watershed.

This Project Area is one of the first on the Ketchikan Area to implement a road condition survey protocol. The protocol is based on the Stikine Area format that was further modified by Area and ADEC personnel. It has resulted in corrections to culverts (cleaning and

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providing for fish passage) through road maintenance in the Sea Level Project Area (see Chapter 3 - Roads and Facilities).

Stream Restoration and Rehabilitation Opportunities

Per BMP 12.3 *Watershed Improvement Planning and Implementation*, stream restoration plans located in Appendix E identify objectives and cost estimates of restoration. Table 3 of the *Fisheries Resource Report* lists four categories of restoration: (1) RMA vegetation manipulation (thinning) where harvest occurred to the stream bank; (2) Slash manipulation in streams where slash causes migration barriers or channel widening; (3) Bank stabilization where erosion causes excessive sediment input to the stream; and (4) Instream structure where surveys identified structure as a limiting factor of quality habitat. Analysis of stream surveys indicates approximately 6,000 meters of stream contain segments where slash removal or manipulation and RMA vegetation manipulation could occur. The streams fall primarily within 14 watersheds in three VCUs: 7560, 7530, and 7460. This problem does not occur as a result of timber harvest or blowdown on the west side of Carroll Inlet (Shelter Cove Sale Areas) or on the east side of Thorne Arm, Elf Point to Fish Creek. The stream surveys analysis identified only a few instances where LWD or instream structure was a limiting factor for quality habitat. The results of the road condition surveys are in the Planning Record. The surveys identified maintenance and stream crossing concerns and restoration needs; see also the Roads section of this chapter.

Appendix E displays stream restoration projects and costs. The projects require no further NEPA clearance as they are assessed as part of this Project. The projects may or may not be implemented with revenue associated from this project but the projects are now listed on the Ketchikan Area Fisheries and Watershed 5-year action plan. The projects were identified during Basin-Wide Surveys and primarily include watersheds with past management activities. They include the following streams in VCU 7460: Marble Creek 101-45-10860, Calamity Creek 101-45-10850, Licking Creek 101-45-10830; VCU 7530 Painted Creek 101-45-10880 and Easy Creek 101-45-10870; VCU 7560 includes Unnamed (Daniel Creek) 101-43-10190, Unnamed (Whistler Creek) 101-43-10290; and in VCU 7530 Unnamed (Stonewash Creek) 101-45-10880-2003.

Cultural Resources

Key Terms

Cultural resources—all evidence of past human-related activity, dating from the earliest beginnings to the fairly recent past.

Historic—the written cultural record post 1741 and Vitus Bering's second Kamchatka expedition.

Prehistoric—the oral cultural record pre 1741.

Sensitivity Zone—defined as "high" or "low", based on the probability that they might contain cultural resources.

SHPO—State Historic Preservation Officer.

Affected Environment

Introduction

Cultural resources include all evidence of past human-related activity, dating from the earliest beginnings to the fairly recent past.

The oldest sites located in Southeast Alaska to date are approximately 10,000-years old and are characterized by microblades (small stone blades with sharp cutting edges) and microblade cores (the prepared stone from which blades are removed) (Davis et al. 1989, Davis 1990). These types of tools are thought to be associated with cultures which adapted to a marine resource economy and which were present approximately 10,000- to 5,000-years ago. This technology seems to have been replaced by a ground and polished slate tool industry (Davis et al. 1989, Davis 1990).

The Sea Level Project Area has a unique cultural history, which includes the potential for occupation dating from the Paleomarine-Early Prehistoric Maritime period (10,000 B.C. to 4500 B.C.) through the Northwest Coast Developmental Phase - Late Prehistoric Maritime (4500 B.C. to A.D. 1700) to the protohistoric-historic Tlingit. Prehistorically, extensive use of the rugged terrain in the Project Area is indicated. A number of fish traps, both stone and wood-stake fish weirs, middens, and rock art sites have been identified. Historically, the various traders, miners, fishermen, loggers, subsistence users, and the USDA Forest Service (from 1907 to the present) have had an effect on the Area. Historic sites include mines, cabin sites, a fox farm and culturally modified trees.

Many of these cultural remains provide the only record of former human occupation, work areas, and life-styles. Some of these sites may represent cultural traditions associated with early human migration into Alaska, and others may be significant for European exploration and historic economic development. Additionally, some areas may have traditional or spiritual significance for contemporary Native Alaskans. The recovery of information from these sites and objects is important in reconstructing previous human behavior and adaptation in response to environmental or social change and represent an important part of our local, regional, and National cultural heritage.

Ethnohistory

The Project Area is included in the traditional homeland of the Tlingit. Immediately prior to the time of European settlement, the Project Area was occupied by two Southern Tlingit groups, the Sanyakwan (also referred to as Saxman or Cape Fox Tribe) and the Tantakwan (also referred to as Tongass or Ketchikan Tribe). The northern half of Revillagigedo (Revilla)

Island was also apparently occupied at one time by the Xetlkwan (Foam House People or the Stikine Tribe) who more recently reside in the Wrangell area.

The Stikine are said to have originally settled at the mouth of the Chickamin River. Both the Cape Fox and Tongass tribes have origin stories which suggest population movement from the mainland through the mouth of the Unuk River, but have had separate histories since that time. The original territory of the Cape Fox Tribe (from north to south) included the southwest portion of the Cleveland Peninsula, the southern half of Revilla Island, and the west coast of the mainland south to the Portland Canal area (Goldschmidt and Haas 1946: 134).

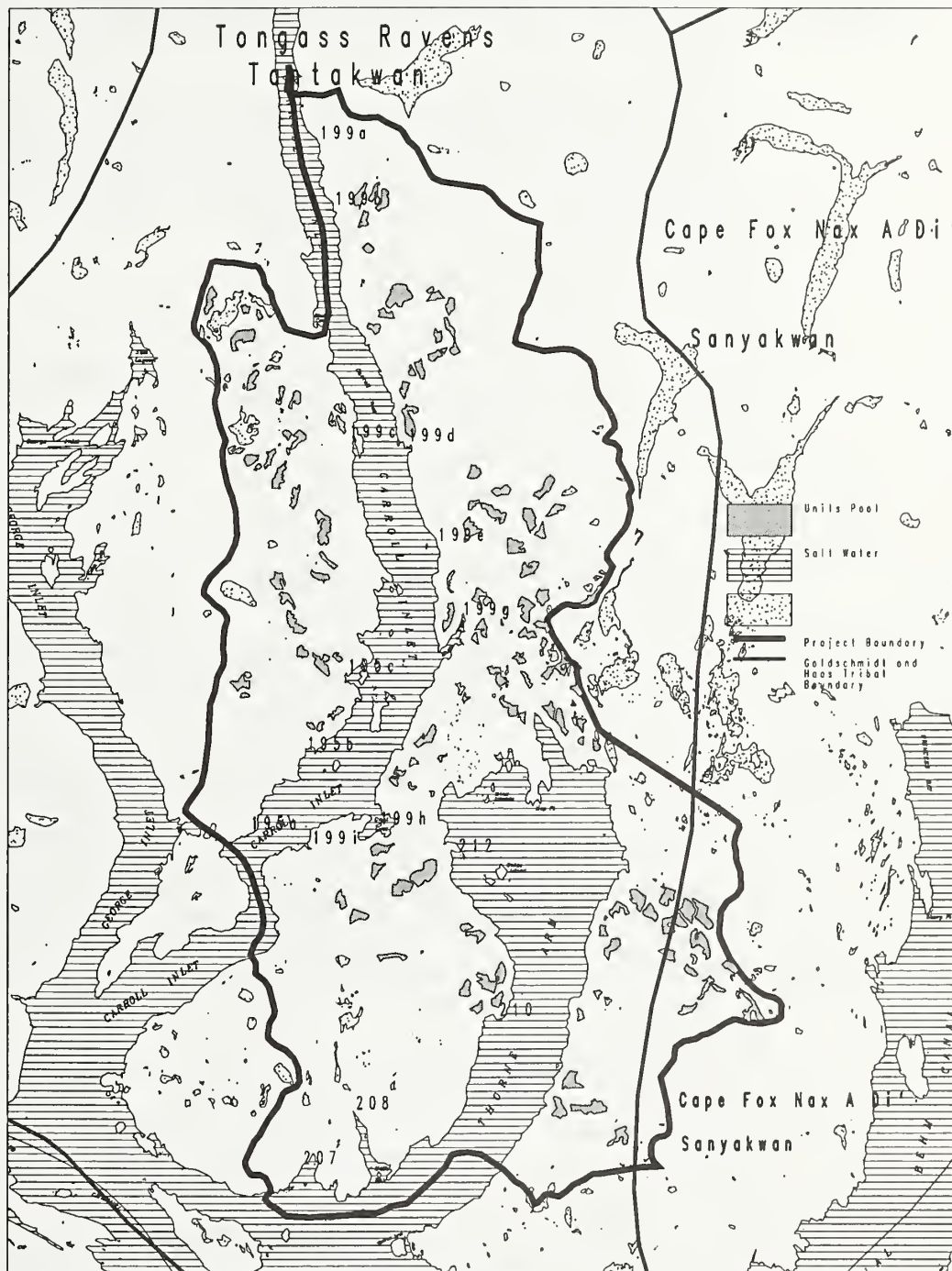
Although the Cape Fox Tribe remained in place on Revilla Island, the Tongass Tribe has a long history of migration. Originally centered on one-third of southern Prince of Wales Island, the Tongass Tribe, as a result of Kaigani Haida encroachment which began around 1720, migrated east. The resulting displacement and competition for resources eventually led to major conflicts between the Tongass and both the Cape Fox and Stikine Tribes in the early part of the nineteenth century. As a result, the Stikine abandoned the area and moved to Wrangell, their territory absorbed by the Cape Fox; the Tongass in the end displaced the Cape Fox from their southern territory and the southwest coast of Revilla Island. By the end of the nineteenth century, however, due to increased Euro-American influence in the area, both groups consolidated and established separate settlements on the southwest coast of Revilla Island—the Tongass at the present day city of Ketchikan, the Cape Fox at Saxman (Arndt, Sackett and Ketz 1987: 85-162).

The written cultural history in Alaska began with the second Kamchatka Expedition of Vitus Bering in 1741 and developed through various stages of contact with European people and goods. Historic explorations in the Project Area occurred in 1792, with the Jacinto Caamano expedition, and in 1793, when George Vancouver's long boats explored Behm Canal from Port Protection where the British ships *Discovery* and *Chatham* were anchored (Mobley 1989: p9).

Figure Cultural-1 displays the areas of the Tongass, Cape Fox, and Stikine tribes in and around the Project Area in 1888, as depicted by G.T. Emmons.

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Figure Cultural-1
Sea Level Project Area Primary Native Cultures and Tlingit Place Names in 1888



Cultural Resources Inventory

In accordance with the National Historic Preservation Act of 1966, as amended, the National Environmental Policy Act (NEPA) of 1969, and a series of implementing regulations and policy direction, the Ketchikan Administrative Area of the Tongass National Forest is undertaking a program to identify, evaluate, preserve, and protect cultural resources as a nonrenewable National heritage. The purpose of the cultural resource investigations is to identify any possible impacts that proposed activities would have on recorded cultural resources in the area that may be eligible for inclusion in the National Register of Historic Places.

Under a programmatic agreement with the Advisory Council on Historic Preservation and the Alaska State Historic Preservation Officer (SHPO), the USDA Forest Service, Region 10 has established guidelines that define high and low "sensitivity zones", based on the probability that they might contain cultural resources. Through a review and analysis of existing data, areas of high sensitivity for various historic or prehistoric site types have been determined. All areas designated as high-sensitivity zones require field investigation and a search of existing data. These sites include

- from sea level to 100 feet in elevation,
- in proximity to known site locations at any elevation,
- lakes and streams containing salmon species within 100 feet above sea level,
- areas of limestone or volcanic materials where caves or rock shelters are likely,
- passes and portages,
- known previous land-use patterns,
- fossil beaches,
- mineralized zones where mining activity has occurred, and
- myth or legend sites.

Low-sensitivity zones include all other areas over 100 feet above sea level, muskegs, and areas where, because of specific environmental conditions, the probability of the occurrence of cultural resources is so low it is essentially zero.

The analysis process for the cultural resource inventory began with a search of the existing literature to identify any previous work, known cultural sites, and mining properties located within the Project Area and in or near proposed harvest units or road right-of-way. A number of sources were consulted, including the Alaska Heritage Resources Survey, the National Register of Historic Places, the Forest Service site and survey files, and the Tongass National Forest Cultural Resource Overview (Arndt, Sackett, and Ketz 1987). A literature overview, that included ethnohistoric information pertinent to Southeast Alaska Natives and other ethnic groups who have prehistoric or historic ties to the lands within the National Forest, was supplemented by public comment and any additional reports submitted to the Forest Service that might pertain to the Project Area. The literature search resulted in the identification of 13 previously documented cultural resource sites.

Archaeological Investigations

Systematic archaeological investigations have been conducted in the Project Area with the majority of the documentation contained in unpublished field notes on file. The following is a summary of investigations performed in the immediate vicinity of the Project Area and the subsequent findings.

- 1978: a survey of Shelter Cove documented one site, KET-015, located within the Project Area.
- 1990: a survey of Shelter Cove located no additional cultural resources.
- 1992: a survey of two harvest units for a Shelter Cove independent sale within the Project Area, located no cultural resources.
- 1994: an intensive survey of 17 miles of shoreline in Carroll Inlet.
- 1995: an intensive survey of 24 miles of shoreline and 12 harvest units in Thorne Arm.

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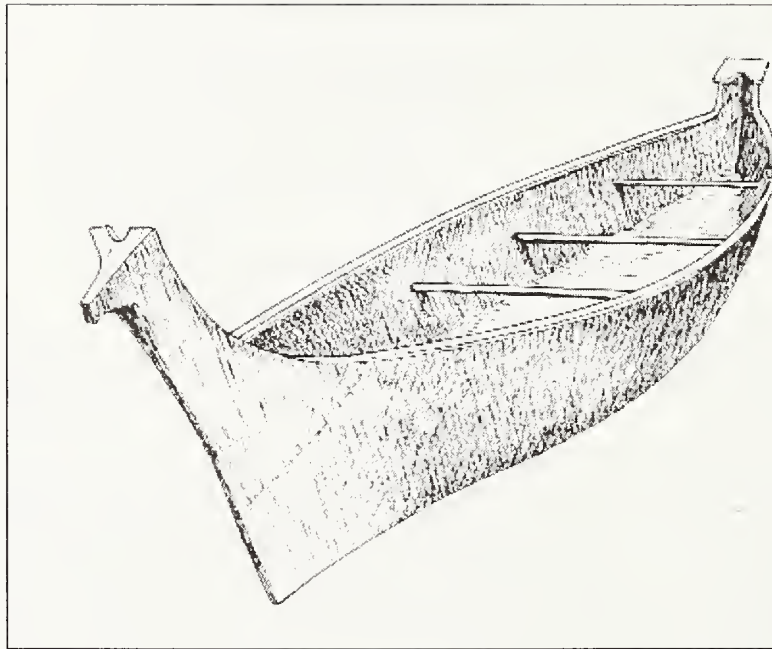
Traditional-use areas indicated by Tlingit place names (Waterman 1922) along the Project Area's coastline have been identified. While place names do not always indicate the location of cultural resources, they suggest use and familiarity with geographic location and association with legends. All of these place names have varying degrees of potential for locating cultural resources. Tlingit place names in the Project Area as identified by Waterman are shown in Table Cultural-1 and are located in the Figure Cultural-1.

Table Cultural-1
Tlingit Place Names for Sites in the Project Area

Number	Waterman Name	Location	Waterman comment
199a	Gil'i Shaakhu	Shoal Cove, Carroll Inlet	Little Mountain Cliff
199b	T'ahèeni	North of Licking Creek	King Salmon Stream
199c	Tsàa Eeji	Rock opposite Marble Creek	Seal Creek
199d	Yakw Tak' x' àas	Creek at Shoal Camp	Falls alongside Canoe
199e	Se Yadi	Shoal Cove	Baby of Yakw tExtEx'a'
199g	Gut'te	Near Shoal Cove	Rock
195c	Tat tooK Xh'ay èe Héen	Bay West of Osten Island	Stream Below Entrance
195b	Ch'èixh' Nòowk'u	Bay near Hume Island	Thimbleberry, small for
199h	Dèishu Ghèeyak'w	End of Tramway Cove	Cove at end of portage
195a	S'in[y]axéen	Carroll Inlet, opposite side	Celery tree
199i	Ooxjàa Héen	Gnat Cove, Spit Point	Wind Stream
212	Tàakw.àank'i	Near Snipe Island	Little Winter Village
210	Naandaat	Eve Point	Floating fort
208	Kalsakhsk'i	Moth Cove	Yew wood Bay
207	Shàaw Datéen	Cena Cove, west of Thorne	Gumboots

Source: Waterman 1922.

Note: Assistance in modern spelling from Tongass Tribe and Esther Shea, July 1993.



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Table Cultural-2 displays known sites by site type, Alaska Heritage Resources Survey site number, relative elevation above sea level, and whether the site is historic or prehistoric.

Table Cultural-2
Sites and Mines Identified within the Project Area

Site Type	Alaska Heritage Resources Survey	Elevation	Date
Cabin	KET-011	<100	Historic
Rock Art	KET-019	<100	Prehistoric
Mine	KET-028	<100	Historic
Fish trap	KET-074	<100	Prehistoric
Rock art	KET-075	<100	Prehistoric
Fish trap	KET-079	<100	Prehistoric
Fish trap	KET-091	<100	Prehistoric
Fish trap	KET-107	<100	Prehistoric
Cabin	KET-108	<100	Historic
Canoe run	KET-300	<100	Prehistoric
Rock shelter	KET-302	>300	Prehistoric
Fish camp	KET-306	<100	Historic
Fish traps	KET-349	<100	Prehistoric
Rock art	KET-418	<100	Prehistoric
Midden	KET-422	<100	Prehistoric
Midden	KET-423	<100	Prehistoric
Midden	KET-424	<100	Prehistoric
Midden	KET-426	<100	Prehistoric
Fish trap	KET-427	<100	Prehistoric
Fish trap	KET-428	<100	Prehistoric
Fish trap	KET-436	<100	Prehistoric
Fox Farm	KET-437	<100	Historic
Canoe run	KET-438	<100	Prehistoric
Cabin	KET-439	<100	Historic
Mine	KET-440	>200	Historic
Cabin	KET-441	<200	Historic
Mine	KET-442	<100	Historic
Cabin	KET-443	<100	Historic
Cabin	KET-445	<100	Historic

Source: Autrey, 1997.

Survey Strategy in the Project Area

The Sea Level Inventory strategy involved sampling of the Project Area in the (1) high-sensitivity zone, areas where traditional subsistence activities and/or other cultural activities/sites were likely to occur, and (2) a sample of harvest units in the low-sensitivity zone. Specific areas included: inter-tidal areas, beach fringes, riparian zones, resource-procurement areas, uplifted fossil beaches, passes or portages, myth and legend sites, karst topography and mineralized zones. A variety of other characteristics were also considered in designing where the surveys were to be conducted, such as eustasy (changes in sea level) and isostasy (rebounding of the earth's crust since deglaciation), and landform configurations. Due to elevation and sea level changes after deglaciation, the location of the earliest areas of human activity may be further inland and at higher elevations than subsequent human activity areas. The environmental characteristics that invited human use and habitation in prehistoric and historic times are often the same factors which invite use today.

Surveys consisted of systematic pedestrian inspection of an area, subsurface examination through inspection of root wads, cut banks, or other natural exposures, and intensive soil probe testing. An inventory was prepared of culturally modified trees in the survey areas. This strategy resulted in maximum survey coverage in the areas of highest sensitivity for cultural resources.

There are no proposed harvest units located within the high-sensitivity zone under any of the action alternatives.

Results of Cultural Survey

Intensive cultural-resource surveys in the Project Area in 1994 and 1995 included approximately 1,425 acres. These surveys identified and documented 16 previously undiscovered cultural resource sites in addition to 13 cultural-resource sites previously documented. The results of the survey of Waterman Native Place Name locations (see Table Cultural-1, earlier in this section) indicates that many of these sites were probably locational names only. At a number of these identified locations, previous disturbance was noted that would in effect have eliminated intact cultural resource remains had they existed. The results of these investigations have been formalized in clearance report documentation and forwarded to the SHPO for review as required by the National Historic Preservation Act and 36 Code of Federal Regulation 800. Additional intensive survey efforts, documentation, and SHPO review will be required should proposed activity areas be changed through Project redesign, the acquisition of additional pertinent information, or as a result of SHPO comment prior to Project implementation.

The information gathered from the data search, literature overview, and intensive archaeological investigations provided information about resource distribution and sensitivity to damage. This work provided information with which to make decisions about the potential effects to significant cultural resource sites within the Project Area. Specific locational information is protected to prevent vandalism or unauthorized use of these sites.

Effects of the Alternatives

Direct and Indirect Effects

Types of Potential Impacts

The preservation and protection of cultural resources are closely associated with the location of the resources, the nature of the management activity, and the environmental characteristics. Impacts to the resource may occur from natural forces (such as erosion), public access, or Project-related activities.

Project activities include the construction and reconstruction of roads, which can lead to an increase in opportunities for public use of cultural resources in the Project Area. Such increased use may enhance understanding of the past—capturing knowledge and information that can disappear over time due to natural decay—and may provide opportunities for interpretation and education. However, public use can destroy cultural resource sites through inadvertent damage caused by compaction or other ground disturbing activities.

Vandalism—including relic collecting, defacement, and theft—results in the loss of information and the destruction of the resource. Protection of significant cultural resource sites from inappropriate public use includes the establishment of public education programs, maintaining confidentiality about specific site locations, monitoring, and directing the public away from the most vulnerable sites.

Specific Potential Impacts

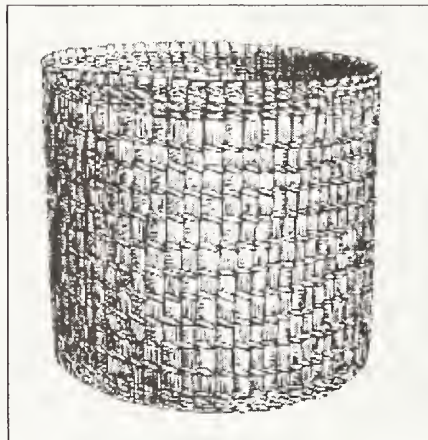
Management recommendations and avoidance of cultural resources will result in zero effect in all of the Alternatives.

Cultural resource sites associated with proposed activities have been evaluated for significance through established criteria in 36 Code of Federal Regulations 800. In consultation with the SHPO, cultural resource sites KET-437, KET-439, KET-440, KET-441, KET-442, KET-443, and KET-445 have been determined to be "Not Eligible" for the National Register of Historic Places. The cultural resource site KET-015 is located in close proximity to the log-transfer facility (LTF) at Shelter Cove. Current restrictions on the operation of the LTF to avoid the site area and monitoring of the site will continue. No timber harvest or road construction is planned within the proximity of any of the significant sites under any of the proposed alternatives. The SHPO has concurred that there will be no effect to significant cultural resources from activities proposed in the Sea Level EIS.

Cumulative Effects

Impacts from natural decay, landscape changes, private developments, and timber management activities collectively result in the loss of the cultural resources in Southeast Alaska. Development activities of all kinds pose particular threats to cultural resources as such activities tend to be located in the same areas that cultural resources are found, such as sheltered coastal settings.

It is impossible to determine the exact nature of resources that may have been previously disturbed in the Project Area. Intensive cultural resource investigations and mitigation measures have been implemented only since the 1980s. Current research and survey designs are based upon the results of previous work and modern methodology and technology. When combined with various mitigation measures, they will preserve significant sites and provide data that will guide future research and resource management.



Ecological Landtypes

Key Terms

Alluvium—material deposited by rivers and streams, including sediment laid down in riverbeds, floodplains, estuaries, and at the foot of mountain slopes.

Ecological Landtype—the unit of land classification which combines the terrestrial-biotic and abiotic components in an ecological relationship.

Ecosystem—a complete, interacting system of organisms together with their environment (for example, a bog, forest, or lake).

Glacial till—the gravel, boulders, sand, and finer materials, transported and deposited by a glacier.

Mass Movement Index (MMI)—the rating used to group ecological landtypes that have similar properties with respect to the stability of natural slopes.

Muskeg—a type of bog that has developed in depressions or flat areas; poorly drained, acidic, with organic soils that support vegetation that is predominantly sphagnum mosses and heaths.

Riparian area—the area including a stream channel, lake, or estuary bed; the water itself; and the plants that grow in and on the land next to the water.

Sediment—the solid materials, in suspension or transported by water, gravity, ice, or air.

Slip plane—the closely spaced surfaces along which differential movement takes place in rock.

Soil—the top layer of the earth's surface, consisting of rock and mineral particles mixed with organic matter.

Soil productivity—capacity of a soil to produce plant growth, due to the soil's inherent chemical, physical, and biological properties.

V-Notch—a shallow to deeply cut stream drainage, generally in steep, mountainous terrain; would look like a "V" from a cross-section. These abrupt changes in terrain features are often used as harvest unit or yarding boundaries.

Affected Environment

Ecological Landtypes

In Southeast Alaska, terrestrial ecosystems have been classified on the basis of natural soil-vegetation complexes (Stephens et. al. 1969; Babik, 1995). The ecosystems include biotic and abiotic components of the landscape, and are grouped into broad categories called "families" which are environmentally similar. The families are subdivided into "ecological landtypes". Within each landtype, species composition, productivity, secondary-plant succession, and ecosystem functions are similar. Ecological landtypes are subdivided into "phases" or "subtypes", based on soil and geomorphology characteristics such as soil depth, substratum character, or landform. The ecological landtypes in the Sea Level Project Area are displayed in Table Ecological-1.

This classification system describes conditions on the Ketchikan Ranger District and Misty Fiords National Monument that differ in some respects from other regions in the Forest and State. These variations are due primarily to latitude effects on temperature gradients, differences in landform and parent materials, and associated vegetative composition and soil development. The Ecological Classification and Inventory was developed to obtain

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information, within an ecological framework, for integrated resource planning and management, including the conservation of biological diversity. The evolution of ecosystem management will depend, in part, upon how well we define ecosystems and their processes, and survey resources through long-term research and monitoring.

Landscapes in southern Southeast Alaska differ in age, geomorphology, hydrology, vegetation density, species composition, successional dynamics and productivity. The landscape is a complex ecological mosaic inadequately described by inventories that focus on geology, hydrology, soils or vegetation alone. The shallow-rooted habits of most native tree species require characterization of more than just agricultural soil characteristics to understand tree growth and response. Extremes in moisture regimes and site hydrology affect species composition and growth. The ground flora may be more diverse than the forest canopy, have important wildlife value, and is often silviculturally significant. Consequently, landscape ecosystems around Ketchikan have to be defined by combinations of geologic, vegetative, soil, hydrologic and ground surface features.

The Ecological Classification and Inventory divides the landscape into a nested spatial hierarchy, with a few exceptions. Upper levels, or Sections and Subsections, are defined by macroclimate and regional physiography. The Project Area is located within the Carroll Inlet/Swan Lake, Thorne Arm and George Inlet Ecoregion Subsections. The Carroll Inlet/Swan Lake Subsection consists of a complex of glacially-carved, U-shaped valleys containing numerous lakes, and rounded alpine ridges. This Subsection includes much of east-central Revillagigedo (Revilla) Island. The principle streams, Carroll Creek and Falls Creek, drain into Carroll Inlet. The relief is generally mountainous and elevations range from sea level to more than 4,500 feet on the summit of Mount Reid. The vegetation includes alpine tundra, subalpine-conifer forest, muskegs, coastal temperate rain forest and riparian spruce-hardwood forest. The George Inlet Subsection consists of coastal lowlands on south-central Revilla Island. This Subsection includes that area to the north and east of George Inlet and associated small islands. Local relief is low, generally ranging from sea level to just over 2,000 feet. The principle watersheds are Leask Creek and Salt Creek. This landscape is relatively flat, consisting of till-plains, marine terraces and metasedimentary bedrock. The vegetation consists mainly of coastal temperate rainforest and muskeg. The Thorne Arm Subsection consists of coastal lowlands on Revilla Island. This Subsection includes that area surrounding Thorne Arm and associated small surrounding islands. The main watersheds include Fish, Gokachin and Sea Level Creeks. The Fish Creek watershed includes several large lakes: Big Lake, Basin Lake, Third Lake and Mirror Lake. Gokachin Lake and Mesa Lake are in the Gokachin Creek watershed. The local relief is low, generally ranging from sea level to just over 2,000 feet. This landscape is relatively flat, consisting of till-plains, marine terraces and metasedimentary bedrock. The vegetation consists mainly of coastal temperate rainforest and extensive areas of muskeg.

Intermediate levels, or Landtype Associations (LTAs), are defined by geomorphology and gross differences in Potential Natural Vegetation (PNV). Lower levels, Ecological Landtypes (ELTs) and Ecological Landtype Phases (ELTPs), are defined by ground flora composition and abundance, soils, substrata, and local physiography.

The ecological landtype classification is designed to stratify the landscape of Southeast Alaska into practical ecological landtypes to serve as a basis for interpretation and management. For a more detailed description of the ecological landtypes of Southeast Alaska see, a *Field Guide to the Ecological Classification and Inventory System* (Babik 1995).

Table Ecological-1
Ecological Landtypes

		Acres Within Project Area
Estuarine Meadow		
E1	Sedge meadow wetland ecosystem	13
E2	Hairgrass meadow wetland ecosystem	21
E3	Beach ryegrass and silverweed wetland ecosystem	38
Forest		
F1	Deep, well-drained soils, high site productivity, western hemlock plant series	2,674
F1t/f1t	Young forest ecosystems on alluvial soils, very high site productivity, Sitka spruce plant series	1,061
F12	Shallow to deep, well-drained soils, high site productivity, western hemlock plant series	261
F2	Shallow, well-drained soils over bedrock, high site productivity, western hemlock plant series	18,970
F2a	Shallow, well-drained soils over volcanic ash, high site productivity, western hemlock plant series	1,021
F2k	Shallow, well-drained soils over carbonate bedrock, high site productivity, western hemlock plant series	573
F2r	Very shallow, well-drained peat soils over bedrock, moderate site productivity, western hemlock plant series	2,471
F3b	Very deep, well drained beach soils, very high site productivity, Sitka spruce plant series	25
F4r	Moderately deep, somewhat poorly drained, low productivity soils, western hemlock or mixed conifer plant series	19,345
F5	Deep, poorly drained soils, very low site productivity, mixed conifer plant series	10,941
F6	Somewhat poorly drained soils of subalpine zone, mountain hemlock plant series	11,155
Muskeg		
M1	Sphagnum bogs, deep fibrous peat	24
M2	Sedge and heath dominated bogs and fens	5,236
M3	Tall sedge fens, deep peat, and muck	334
MF5	Complex of sphagnum bogs, sedge fens and forested wetlands, mixed conifer plant series	8,390
Alpine		
A1	Alpine heathlands	3,212
A2	Alpine sedge meadows	189
AF6	Complex of alpine meadows, heathlands and subalpine forestland, mountain hemlock plant series	5,299
Brush-slope		
B	Avalanche tracts and snowload slopes dominated by Sitka alder	3,572
Alpine Rockland		
R	Bedrock, mostly unvegetated, with only a partial cover of lichens, mosses, and a few alpine forbs and grasses	852

Source: Babik 1996.

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Soils

Soil development in Southeast Alaska is influenced by high levels of rainfall, cool maritime temperatures, and moderately low annual soil temperatures. Under these conditions, organic matter decomposes slowly, resulting in a thick layer of organic material. Disturbances also play an important role in the development of soils. Wind-throw, flooding, and landslides alter the soil surface and subsoil. The other ecosystem components which influence soil features are: parent material, topography, vegetation, animals, and climate. Soils influence the overall ecosystem functions, vegetation composition, water quality, riparian area and wetland values, and the productivity of timber, fish, and wildlife in the Project Area.

A soil survey which identifies the soil types, and their distribution and extent, has been completed (*Soil Survey for the Ketchikan Area*, USDA Forest Service, unpublished). Soil descriptions and pertinent soil references are available in the Ketchikan Area Supervisor's Office. Soil references include: the *Tongass Land Management Plan* (TLMP 1997) Chapters 2 and 5; the *Forest Ecosystems of Southeast Alaska* (Swanston 1974); the *Southeast Area Guide* (USDA Forest Service 1977); the *Alaska Regional Guide* (USDA Forest Service 1983); and soil-survey maps and associated soil series and map unit descriptions. Additional information on riparian and wetland soils is located in the Floodplains and Wetlands section of this chapter.

Additional site-specific information is available in the Sea Level harvest unit folders, located at the Ketchikan/Misty Fiords Ranger District office.

Ecological Site Productivity

Site productivity is a critical element of terrestrial ecology since it affects the productivity of the entire forest ecosystem. Tree growth, wildlife and fish habitat, rare plant species, and subsistence plant gathering are all dependent upon the productivity of the site. In the Project Area, timber site productivity and forage production ranges from very high on moist, well-drained floodplains, to medium and high on moderately well and well-drained upland sites, to low on poorly drained sites. On the Ketchikan/Misty Ranger District site index is used to describe how high a Sitka spruce tree will grow in a certain amount of years. Using 50 years as a time span, on sites with a site index of 45, a 50-year old Sitka spruce would be 45 feet tall. On sites with a site index of 60, a 50-year Sitka spruce would be 60 feet tall. Site category is used as a classification of timber site productivity on the Ketchikan Area. Site categories 1 through 3 are defined as follows:

Site Category	Site Index
1 (low)	45 to 56
2 (medium)	57 to 66
3 (high)	+ 77

The acreage by site category, within the Project Area, is listed below in Table Ecological-2.

Table Ecological-2
Ecological Site Productivity Classes in the Project Area (Acres)

1 (Low)	2 (Medium)	3 (High)
43,912	18,970	5,605

Source: Babik 1996.

Because of the role which organic matter plays in forest productivity, maintaining the organically-enriched topsoil layers is important for maintaining long-term ecosystem productivity. Site productivity and its related nutrient content can be influenced in a number

of ways by natural disturbances and timber management activities. Removal of the surface layer may be caused by windthrow, flooding, landslides, surface erosion, severe yarding disturbance, or from displacement by roads, skid trails, landings, or rock pits. Soils can be altered by puddling, which impairs soil porosity and drainage and therefore reduces productivity. Reductions in site productivity that last beyond the planning period are considered to be significant impairments. A 15 percent reduction in inherent site-productivity potential is the threshold for measurable or observable site properties associated with long-term productivity (FSM 2554.03).

However, site disturbance should not be considered entirely detrimental. Site disturbance, whether natural or management induced, can increase biological diversity by providing site conditions which enhance the regeneration of early mid-seral-stage species, such as fireweed, salmonberry, red alder, and Sitka spruce. Flood waters and landslides also deposit soil materials which develop into some of the highest productivity floodplain and footslope sites in the area.

Erosion

Two major types of erosion occur within the Project Area: (1) surface erosion and (2) landslides.

Surface Erosion

Most undisturbed sites in the Project Area are resistant to surface erosion because they are generally protected by layers of organic matter and the roots of vegetation. However, when mineral soils are exposed, erosion can occur. The rate of erosion depends primarily on the amount of vegetation ground cover, erodibility of the soil, and the steepness of slope. Locations where surface erosion and mass wasting are most likely are along stream banks, snowslide or avalanche slopes, and within V-notches. Timber-harvest activities and road construction may increase the erosion rate by exposing mineral soil.

Landslides

Landslides are the dominant process of natural erosion in ecosystems of Southeast Alaska. Many landslides occur during or immediately after periods of heavy rainfall when soils are saturated. Landslides usually occur on steep slopes that have soils with distinct subsurface slip-planes, such as compact glacial till or bedrock that slopes parallel to the ground surface. These areas have a high likelihood of landslides, either naturally occurring, or if disturbed by blasting rock or road pioneering, side casting of excavated material, or logging practices that cause substantial surface disturbance.

Vegetation, particularly tree roots, have a stabilizing effect on slopes, but tree roots tend to decrease in strength 5 to 7 years after a tree is cut (Swanston 1989). This decrease in soil-holding capacity results in an increased likelihood of slope movement on steep slopes following clearcutting. Effects of partial cutting on slope stability in Southeast Alaska are relatively unknown. Under natural conditions, windthrow triggers landslides in Southeast Alaska. Recent research in Southeast Alaska (Swanston 1989) has suggested that although less than 10 percent of all landslides in the past 20 years were related to logging or roads, logging and roads may increase the potential for landslides in a given area.

A broad analysis of slope stability conducted on the Project Area was based on the Ketchikan Area Soil Survey. Landslide potential, expressed as the mass movement index (MMI) ratings, was used to group ecological landtypes that have similar properties with respect to the stability of natural slopes. Four classes of MMI, 1 (low), 2 (medium), 3 (high), and 4 (very high), have been assigned to ecological landtypes according to their relative potential for landslides, as indicated by their physical properties.

Naturally unstable slopes are common throughout the Project Area. Table Ecological-3 shows total acres of each MMI class in the Project Area by Value Comparison Unit. These

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MMI ratings are based on general characteristics of typical ecological landtypes found in the Ketchikan Area.

Table Ecological-3
Mass Movement Index Classes in the Project Area by Watershed (Acres)

Watershed	MMI = 1	MMI = 2	MMI = 3	MMI = 4
Calamity Creek	828	1,246	793	1,314
Painted Creek	1,151	1,210	3,655	914
Sea Level Creek	2,260	1,737	1,257	717
Licking Creek	791	624	2,105	565
Marble Creek	584	1,053	1,635	398
Saddle Lakes	1,916	830	1,241	138
All Other Watersheds	19,565	13,450	21,357	6,993
Total	27,095	20,150	32,043	11,039

Source: Babik 1996.

A more detailed, ecological-landtype-phase inventory of the Sea Level Project Area, which included potential timber-harvest units and proposed roads, was conducted during Project development. Maps in the Sea Level Planning Record display the distribution of high and very high MMI sites, in relation to roads and harvest units. These areas are also displayed for each unit in Appendix 1 of the Sea Level ROD. Very high MMI sites are not suitable for timber harvest, as described in the TLMP (1997), Timber Suitability Classification, pp. A1-16.

Effects of the Alternatives

Direct and Indirect Effects

Ecological Site Productivity

The action alternatives have the potential to reduce ecological site productivity. However, application of ecosystem management practices for the maintenance or improvement of site productivity (FSH 2509.18), will limit these reductions to below threshold levels (FSM 2554 R10 Supp. 2500-92-1). Furthermore, units were located and designed during the planning process to minimize adverse effects on site productivity. An analysis of timber harvest on the site-productivity classes is included in the Silviculture and Timber section of this chapter.

Ecological landtypes currently supporting productive ecosystems would be disturbed in all the proposed action alternatives to varying degrees. Disturbance of sites by road, landing, and rock-pit construction will result in the loss of soil. Timber harvest may result in site disturbance, displacement or exposure, or puddling that could reduce site productivity. Road construction and timber harvest may result in an increase in the occurrence of landslides (Loggy 1974; Swanston 1989) and may result in reduced productivity on those sites.

Acres of soil displacement which may be expected within harvest units with the proposed silvicultural and yarding systems are displayed in Table Ecological-4. In making these estimates, several assumptions were made:

1. Helicopter yarding systems will result in no soil exposure, regardless of silvicultural system.
2. Soil exposure will occur with all cable yarding and will result in an average of 5.9 percent of the soil surface displaced or exposed within harvest units (based upon work by Landwehr 1992).
3. Shovel-yarding systems will result in an average of 8 percent of the soil surface displaced within harvest units (Landwehr 1992).
4. Partial cutting (see Silviculture and Timber section of this chapter) will result in the same amount of soil displacement as clearcut silvicultural systems.

Table Ecological-4
Acres of Site Disturbance by Alternative

	Alternative			
	1	2	5	7
Acres of Site Disturbance	0	153.0	44.0	92.0
Total Acres Harvested	0	2,843.0	848.0	1,620.0
Percent Disturbance Acres of Total Harvest Acres	0	5.4	5.2	5.7

Source: Babik 1998.

Site disturbances resulting from landslides and other surface disturbances may result in long-term reduction of site productivity. The amount of time required for rehabilitation depends on the severity of the disturbance and its exposure to continued aggravating forces.

Site disturbance enhances the capability of some tree species, particularly Sitka spruce and western red cedar, to regenerate and grow. A certain level of soil scarification is desirable on spruce and red cedar sites to prepare a suitable seedbed. In the absence of site disturbance, regeneration conditions on most sites in Southeast Alaska typically favor western hemlock, a species that regenerates prolifically on undisturbed forest-floor leaf litter.

Erosion

Some erosion and landslides may occur in all alternatives, including the no-action alternative. Erosion will most likely occur on areas where the soil surface has been exposed. The two forms of erosion (surface and landslides) may be accelerated by timber-harvest activity.

Surface Erosion

Some erosion may occur in all alternatives. Erosion will most likely occur on areas where the soil surface has been disturbed. Due to the considerable amount of ground cover remaining on areas after timber harvest, erosion rates are typically quite low. Soil productivity may be reduced and sediment production may increase for a short period of time, until the site is revegetated, typically 3 to 5 years. Since each alternative includes a different amount of timber harvest and road construction, the alternatives are expected to result in differing levels

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of soil erosion. Of the action alternatives, Alternative 2 will result in the greatest amount of surface erosion. Alternative 5 will result in the least.

Landslides

The individual or group tree-selection forest-regeneration harvest methods described in the Silviculture and Timber section of this chapter will help to minimize landslide potential. This silvicultural system maintains a portion of the existing stand, providing better protection of landslide-prone sites by retaining a living root system. Where clearcut forest-regeneration harvest methods are used, a greater risk of landslide potential may be assumed. Landslides are most likely to occur when roads are constructed on landscapes where MMI = 4 (very high). Landslides typically occur less frequently when roads are constructed or timber is harvested on areas with a lower MMI. In most cases landslides are not as common on areas with high, medium or low MMI. Some site disturbance is unavoidable under any reasonably practicable timber-harvest activity.

For the Project Area, 11,039 acres of the land base are classified as MMI = 4. These sites are classified as unsuitable for the production of commercial timber. Timber harvest proposed on areas identified in the ecological-landtype inventory as MMI = 4, required site inspection. During field reconnaissance, these areas were inspected by a professional soil scientist; some were reclassified to MMI = 3 and thereby suitable for timber harvest. Ecological landtype inventory map units typically contain inclusions which may be more suitable for a particular use than the inventoried sites. Inventory data is useful for modeling effects analysis but is not of sufficient detail for use in harvest-unit layout.

According to the TLMP, slope gradients of 72 percent or more have a high (MMI=3) risk of soil mass movement. Timber harvest on slopes in excess of 72 percent is planned on some sites, supported by an on-site analysis of slope and Class IV channel stability by the District soil scientist, and an assessment of potential impacts on downslope beneficial uses, in accordance with the TLMP direction for soil and water management. Logging systems, including the use of helicopter yarding and running skyline, have been designed to minimize site disturbance. Approximately 70 acres on slopes in excess of 72 percent are planned for harvest in Alternative 7.

The site investigations conducted for the Project were designed to identify areas of high-landslide potential (risk). There is no assumption made that the timing, location and condition under which landslides occur may be accurately predicted.

For analysis of the effects of the Project, a more detailed ecological-landtype-phase inventory was conducted. Units with high MMI ratings will receive special consideration by a soil scientist and appropriate Best Management Practices (BMPs) will be applied. Road construction may require a geotechnical evaluation (see Mitigation Measures, Chapter 2).

Table Ecological-5 displays the amount of timber harvest that is proposed on each MMI class within the Project Area.

Table Ecological-5
Timber Harvest in Acres by Mass Movement Index Class

Mass Movement Index Class	Alternative			
	1	2	5	7
Low = 1	0	308	47	139
Medium = 2	0	1,168	518	832
High = 3	0	1,367	283	649
Very High = 4	0	0	0	0

Source: Babik 1998.

Road-building activities are potential sources of landslides and sediment. Preliminary monitoring reports of landslides initiated by road construction within the 89-94 Ketchikan Pulp Company (KPC) Long-Term Sale EIS, showed that 13 landslides occurred within a 2-year period (Landwehr 1992). The total area disturbed from all 13 landslides was less than 3 acres. Minimizing road building over potential landslide areas would lessen the possibility of landslide occurrence and associated impacts. Table Ecological-6 shows miles of road construction proposed on each MMI class for each alternative.

Table Ecological-6
Road Construction in Miles by Mass Movement Index Class

Mass Movement Index Class	Alternative			
	1	2	5	7
Low = 1	0	14	3	7
Medium = 2	0	27	13	19
High = 3	0	16	6	12
Very High = 4	0	2	0	0

Source: Babik 1998.

Of the action alternatives, Alternative 5 proposes building the least amount of road over MMI=3 sites, and Alternative 2 proposes to build the most. There is a low potential for measurable impacts to water quality and fish habitat from management-induced landslides if any of the action alternatives are implemented. The results of a recently completed Tongass-wide landslide survey can help illustrate the potential for landslide impacts in the Project Area (Swanston and Marion 1991). This regional landslide survey, which included only landslides greater than 100 cubic yards of soil displacement, estimates a landslide rate of 1.7 slides over a 20-year period. These results also indicate that a relatively small percentage of sediment generated from large landslide events will reach a stream. Swanston (1989) estimated that the increase in the incidence of landslides over natural occurrences throughout Southeast Alaska was about 3.5 times greater on managed acres.

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Swanston's Tongass landslide survey categorized 23 percent of all landslides as debris torrents that occur in deeply cut V-notch gullies. Long-term (greater than 10 years) impacts to channel form and function and to fish habitat would be anticipated for Class I channel segments directly affected by a large landslide (Hogan and Wilford 1989). Based on Swanston's results, there is about a one-in-four chance that any management-related landslide will have an impact on Class I streams and only a very slight chance that impacts on fish habitat could occur. It can be inferred that the majority of these landslides would affect primarily Class III stream channels, since only about 3 percent of all natural and management-induced slide events in this survey were shown to directly affect Class I streams.

Care should be taken in extrapolating these results to the Project Area. Changes in road construction and harvesting technology, as well as greater sensitivity to water quality and fish habitat concerns (as reflected in the BMPs, for example, and much improved soil and water inventory information), have resulted in more effective management practices for timber operations in landslide-prone areas. These factors will tend to reduce management-related landslide incidences in the Project Area from the rate observed by Swanston. On the other hand, many of the areas included in Swanston's survey had road systems that were predominantly located on stable locations on lower valley slopes. Roaded segments in the Project Area are proposed on relatively steep slopes, a factor which would tend to increase potential for road-related landslides. Thus, the frequency of landslide occurrence in the area is difficult to predict; however, areas with a high potential for landslide occurrence were evaluated in the planning process, and timber harvest was deferred in many of these areas during unit design.

The roads proposed in this Project located on steep slopes require special construction techniques to minimize the potential for slope failure. One of the techniques commonly used on these steep slopes is the excavation and full-bench construction of roads. Full-bench road construction generates large quantities of waste rock and overburden, material which typically cannot be disposed of on these steep slopes. This material must be hauled away and disposed of at a suitable site. Wetlands, riparian areas, or sites with a high risk of slope failure are not suitable disposal sites.

The existing condition (1999) shows that about 86 miles of roads in the Project Area, resulted in a loss of about 350 acres in road right-of-way and rock-quarry development since 1954. Approximately 670 acres of the soil surface are estimated to have been exposed by timber-harvest activity in the Project Area since 1954. Alternative 1 would maintain this existing condition through the year 2007.

Alternative 2 would result in a total of about 240 acres of road construction and rock quarry development by 2007. It is estimated that Alternative 7 would result in a total of about 160 acres of road construction and quarry development. Alternative 5 produces about 90 acres of roads and quarries by 2007. In all instances, the actions proposed would minimize soil disturbance to the maximum extent practicable through implementing the BMPs from the Soil and Water Conservation Handbook (FSH 2509.22).

Cumulative Effects

The TLMP (1997) projects that by 2140, all suitable lands within the Project Area (approximately 21,800 acres) will consist of a mosaic of even-aged stands of varying age classes, two-aged stands, and all-aged stands. A total of 480 acres of road and rock pits would eventually be developed to harvest all suitable and available timber in the Project Area. Cumulative effects of these actions upon long-term site productivity are directly related to the amount of disturbance that occurs through time and the amount of recovery that takes place in the ecosystem during this time. Management activities will incorporate state-of-the-art ecosystem-management practices. By maintaining site productivity in upcoming decades, the cumulative effects of these actions will remain within threshold levels.

Floodplains and Wetlands

Key Terms

Bog—a wetland of slow-moving, nutrient-poor, highly acidic water formed of peat derived predominantly from sphagnum moss.

Estuarine—deep-water tidal habitats and adjacent tidal wetlands that are usually semiencllosed by land, but which have open, partly obstructed or sporadic access to the open ocean, and in which ocean water is diluted by freshwater runoff.

Fen—a wetland of slow-moving, nutrient rich, at times alkaline water with sedge peat forming the substrate.

Hydrophytic vegetation—plants typically found in wetlands and dependent upon wetland moisture regimes for growth and reproduction.

Muskeg—a type of bog that has developed in depressions or flat areas, is poorly drained, acidic, and has organic soils that support predominantly sphagnum mosses and heaths.

Wetlands—areas that are inundated by surface or ground water with a frequency sufficient, under normal circumstances, to support vegetation that requires saturated or seasonally saturated soil conditions for growth and reproduction.

Affected Environment

Floodplains

Floodplains are composed of naturally-eroded sediments carried by the stream or river and deposited in slack water sections of channels during high-water periods. Floodplains are considered to be areas subject to a 1 percent (100-year recurrence) chance of flooding in any given year. Nutrient-rich sediments underlain by coarse-textured sediments make floodplains the most productive lowland-timber, wildlife, and fisheries resource sites on the Tongass National Forest.

Several major floodplains are located within the Sea Level Project Area. The principal floodplains are located along Calamity, Licking, Marble, Painted, and Sea Level Creeks. Floodplains are defined in FSM 2527.05. These floodplains range from 1 to 2 miles long, and range up to 500 feet in width. They contain well defined main channels, a number of overflow and side channels, and areas of beaver-influenced ponds. Some timber has been harvested in the Calamity, Licking, Marble and Painted Creek floodplains in the past. A 100-year precipitation event will inundate most of this area. Smaller areas of floodplains are located along many of the other streams in the Project Area. There are an estimated 1,312 acres of total floodplains within the Sea Level Project Area.

About 14 percent of all floodplain areas within the Project Area has been harvested between 1954 and 1997. Most of the timber harvest on floodplains, about 67 acres, has occurred within the Licking Creek watershed. Timber harvest on floodplains has also occurred in the Calamity and Marble Creek watersheds, with approximately 57 acres cut.

Floodplains previously harvested for timber are now in various stages of secondary-plant succession. Except where the ground is highly disturbed, the stand composition on the secondary-successional floodplains is similar to riparian vegetation prior to timber harvest, with Sitka spruce typically forming the canopy. On the more disturbed sites where mineral

soil was exposed during timber harvest activities, the vegetation is often composed of early-successional species, such as red alder and salmonberry.

Table Floodplains and Wetlands-1 displays the acres of floodplain in each watershed within the Project Area.

Table Floodplains and Wetlands-1
Acres of Floodplains

Watershed	Floodplain
Calamity	135
Licking Creek	200
Marble Creek	81
Painted Creek	35
Saddle Lakes	12
Sea Level Creek	31
Gunsite Creek	47
All Other Watersheds	771
Total	1,312

Source: Babik, 1998.

Wetlands

Wetlands are defined as: "those areas that are inundated or saturated by surface or groundwater with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." (40 CFR 230.41(a)(1)). Identification of wetlands is based on the U.S. Corps of Engineers (COE) three-parameter system described in the U.S. Army COE Wetlands Delineation Manual (COE 1987). Wetlands are identified as areas having hydric soils, hydrophytic vegetation, and wetland hydrology. Soil resource inventory maps, including correlations between soil series and plant communities, were used to determine the extent of wetlands in the Sea Level Project Area. Hydrologic parameters were inferred from the soil moisture regime.

The Tongass National Forest has developed its own system of wetland classification and delineation. This method (DeMeo and Loggy, 1989) was used to describe and analyze wetlands in the Sea Level Final EIS. This system of classification uses the three-parameter approach (COE 1987) adapted to the unique vegetation, soils and hydrology of coastal Southeast Alaska. Using this method of wetland definition and delineation, approximately 50 percent (45,948 acres) of the Sea Level study area (Project Area) is classified as wetland. This extensive wetland area consists of at least 12 different types of wetlands. Each type has different soil and vegetative communities, occupies different landscape positions, and has somewhat different functions and values. These wetland types are described in the Sea Level Planning record. The majority of these wetlands are palustrine open or palustrine forested in the United States Fish and Wildlife Service (USFWS) wetland classification system. The most common wetland type is the forested wetland. Areas of riparian-forest wetlands are

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located mainly along Marble, Painted and Sea Level Creeks. A significant area, about 20 acres, of estuarine-meadow wetlands is located where Painted Creek drains into Shoal Cove.

Wetland Types

The total area of selected wetland types within the Project Area is shown in Table Wetland-2.

Table Floodplains and Wetlands-2
Acres of Selected Wetland Types Within the Project Area

Forested Wetland	Estuarine Meadow Wetland	Tall Sedge Fen	Sphagnum Peat Bog	Scrub-Shrub Muskeg
24,480	49	676	757	12,513

Source: Babik 1998.

For further information on wetlands and wetland habitats see the Sea Level Timber Sale Report, Ecosystem Resource Report (Babik 1997).

Value and Function

Wetland values are defined here as socioeconomic benefits derived from wetland functions, goods and services (quantifiable or not). Some of the most important wetland values in Southeast Alaska include:

- habitat for wildlife, fish and sensitive or endangered plant and animal species,
- timber harvest,
- berry and other edible plant harvest,
- water quality maintenance,
- flood control, and
- recreation opportunities.

Wetland functions are physical attributes of the wetland ecosystem and can be organized as follows:

- Hydro-geomorphic functions are: groundwater recharge and discharge, surface hydrologic control, streambank and shoreline maintenance, erosion control, sediment storage, temperature regulation, microclimate control, karst landscape formation, and maintenance of overall landscape diversity.
- Biochemical functions are: element cycling, maintenance of water chemistry, carbon and nitrogen storage, nutrient export and utilization, and decomposition.
- Biological functions are: primary and secondary productivity, biological diversity, and terrestrial and aquatic habitat for vascular and non-vascular plants, fish, mammals, gamebirds, nongame birds and invertebrates.

The biological significance of a wetland is related to the value of its functions and, at least in part, to the relative scarcity of the wetland type in the landscape. This is especially true in terms of biological diversity on the landscape scale. The relatively scarce fens and estuarine salt marshes in the Sea Level area have a greater biological significance than the more common bogs and forested wetlands which are widespread throughout the landscape.

The interdisciplinary team, made up of specialists in fisheries, forestry, vegetation, watershed and wildlife management, has assigned relative wetland values to the various wetland types found in the Project Area. These wetland values are based upon the social and economic benefits derived from the different types of wetlands, and the relative abundance and location of the wetland types. These wetland values were used in development and analysis of Project alternatives. Wetland values were also considered in making decisions concerning the minimization of development in, or avoidance of, wetlands and the design and implementation of mitigation measures. Further detail on this process is included in Wetland Values Matrix (Appendix F) of Volume II of this EIS.

High-Value Wetlands

This value has been assigned to several wetland types including: estuarine meadows, lakes and ponds, tall sedge fens, and the riparian forest. These wetlands serve as important habitat for anadromous and resident fish. They provide habitat for Sitka black-tailed deer, black bear, marten, mink and other fur bearers. They provide elements of streambank and shoreline maintenance and regulate stream flow and water quality. A number of unique or sensitive plant species are concentrated in these wetland types. These are often high-use subsistence areas. The riparian forests generally have a high site productivity and support high-volume Sitka spruce stands. These wetland types are relatively scarce and are scattered throughout the Project Area. Maintenance of their important functions and values is a high priority. There are approximately 2,234 acres of high-value wetlands within the Area.

Medium-Value Wetlands

These include the alpine tall sedge fens, alder/salmonberry shrublands, short sedge muskeg and sphagnum peat bogs. These wetlands provide seasonally-important habitat for terrestrial wildlife, habitat for unique plant and animal species, groundwater recharge and discharge, and maintenance of landscape diversity. Sphagnum peat bogs and the short sedge muskegs are important berry harvesting areas. Several of these wetland types are in open terrain that provide enjoyable walking and scenic views. They are locally common, but are often concentrated on certain parts of the landscape. There are approximately 4,644 acres of medium-value wetlands within the Project Area.

Low-Value Wetlands

These include those types dominated by scrub forest or low-productivity forest land. These wetland types include the alpine shrubland/muskeg, forested wetlands, scrub-shrub/short sedge muskeg and subalpine forested wetlands. They cover extensive areas of the Project Area. They provide marginal habitat for terrestrial wildlife and aquatic organisms though they have some value for groundwater recharge and maintenance of streamflow. Generally, the timber site productivity of these forested wetlands is low, and they often support noncommercial or marginally-commercial forest stands. The vegetation is often too thick and too difficult to negotiate to provide an enjoyable recreation experience. There are approximately 39,070 acres of low-value wetlands within the Project Area.

Table Floodplains and Wetlands-3 displays which wetland types in the Sea Level Project Area are of low, medium and high value. These values are intended to represent some of the most socially and economically significant values within the Project Area, but are not intended to represent all possible social and economic values and benefits derived from these wetlands.

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Table Floodplains and Wetlands-3
Values of Wetland Types Within the Project Area

High-value Wetlands	Medium-value Wetlands	Low-value Wetlands
Estuarine Meadow	Alpine Tall Sedge Fen	Alpine Shrubland/Muskeg
Lakes and Ponds	Alder/Salmonberry Shrublands	Forested Wetland
Tall Sedge Fen	Short Sedge Muskeg	Scrub-Shrub Muskeg
Riparian Forest	Sphagnum Peat Bogs	Subalpine Forested Wetland

Source: Babik, et. al. 1997.

Effects of the Alternatives

Direct and Indirect Effects

Floodplains

Executive Order 11988 directs Federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are required to (1) avoid the direct and/or indirect support of floodplain development whenever there are practicable alternatives, (2) evaluate the potential effects of the proposed action on floodplains, (3) ensure that program planning and budget requests consider flood hazards and floodplain management, and (4) prescribe procedures to implement the policies and requirements of the Executive Order.

During road construction, both direct and indirect impacts to floodplains may occur. There may be no detectable influence, or there can be flow alteration in minor streams because of routing by roadside ditches and culverts. Channel and flow alteration may locally affect the velocity of flows, width and depth of water, and the location of flow. Such factors may physically result in different erosion and sediment transport characteristics.

Table Floodplains and Wetlands-4 summarizes the number of roads that cross streams and that may affect floodplain areas. All proposed new road construction is included.

Table Floodplains and Wetlands-4
Number of Road Crossings in Floodplains

	Alternative			
	1	2	5	7
Number of Crossings	0	50	15	21

Source: Oien 1998.

Best Management Practices (BMPs) will be used to minimize impacts on floodplains as well as to protect roads and drainage structures. Examples of such practices include designing bridges and culverts to handle the expected flows and installing frequent cross drains or

ditch-relief culverts at natural drainages, and also in places to minimize erosion from large concentrations of water moving overland.

Table Floodplains and Wetlands-5 displays the acres of floodplains within each watershed that have been proposed for inclusion in timber harvest units.

Table Floodplains and Wetlands-5
Proposed Timber Harvest in Floodplains (Acres)

Creek	Alternative			
	1	2	5	7
Calamity	0	0	0	0
Licking	0	0	0	0
Marble	0	0	0	0
Painted	0	3	3	3
Sea Level	0	0	0	0
Total	0	3	3	3

Source: Babik 1998.

Wetlands

On the majority of sites, only low-value wetlands will be affected by planned Forest management activities. The Sea Level alternatives, timber harvest unit design, and road location and construction design have been planned to avoid and minimize the effects upon medium- and high-value wetlands.

Executive Order 11990 requires Federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Federal agencies are required to preserve and enhance the natural and beneficial values of wetlands in carrying out their responsibility for (1) acquiring, managing, and disposing of lands and facilities, (2) providing federally undertaken, financed, or assisted construction and improvements, and (3) conducting Federal activities and programs affecting land use.

Effects to wetlands within the Project Area may be divided into two categories: (1) permanent loss and (2) disturbance. *Permanent loss* is a long-term effect in which wetlands are excavated or filled for features such as roads, landings, and log transfer facilities. The most direct effect upon wetlands would be the fill associated with road construction, although Forest managers are required to consider alternative road locations and effects on wetlands. Roads are located outside of estuarine, lacustrine, and riverine wetlands, to the maximum extent possible, to maintain their function (see Table Floodplains and Wetlands-6, Road Construction and Timber Harvest on Wetlands by Alternative). When it is necessary to cross wetlands, appropriate BMPs and mitigation measures are incorporated into road designs. High-value wetlands, such as tall-sedge fens and riparian forest are avoided if possible. Constructing roads on muskegs and forested wetlands requires rock overlay construction techniques which maintain the physical, chemical, and biological functions of the wetlands. Road construction does cover wetland vegetation with rock, and may result in local changes in wetland vegetation. By minimizing the amount of

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side-ditching, effects upon groundwater flow and alteration of soil moisture levels will be minimized.

Effects will be minimized by not using wetlands for overburden disposal and by minimizing road clearing limits. The interruption of subsurface drainage by making wetlands either wetter or dryer affects long-term site productivity. Detrimentially altered wetness—identified when an area becomes perennially flooded or drained and the effective function or value of the wetland is lost—will be limited to those areas beneath, and within a few feet of, the road. Detrimentially altered wetness will occur on less than ½ of one percent of Project Area wetlands, a range of about 180 acres in Alternative 2, to 112 acres in Alternative 5, well within Regional standards for detrimentially altered wetness (FSH 2554 R-10 Supplement 2500-92-1). When possible, alternate locations on adjacent uplands are used.

Wetland vegetation will be affected by road construction. Monitoring results by Babik (1995) on the adjacent North Revilla Project Area and in the Shoal Cove vicinity indicate that road runoff may affect wetland vegetation composition. Sediment transported in road runoff and fugitive dust appears to add nutrients to roadside sites, lowering acidity and increasing fertility. These chemical changes are particularly apparent in the sphagnum peat muskeg and scrub-shrub evergreen/muskeg wetland types. A change in species composition from acid-tolerant bog vegetation to a more eutrophic, sedge-meadow fen type typically takes place within several meters of the road. Wetland moisture regimes change very little as a result of road construction. Groundwater flow through the typical wetland peat and muck is very slow. Slow ground water flow combined with high precipitation results in no significant drainage when peatlands are ditched. Effects of drainage are usually noticeable within only a meter or two of roadside ditches. These effects have been observed and confirmed by McClellan and Demore (1996) in a study on Wrangell Island.

Disturbance is an activity, such as removal of vegetation, which alters wetland ecological or hydrological functions. Timber harvest on forested wetlands will change the existing vegetation and may affect surface or subsurface hydrology. Site disturbance is not expected to have a significant effect upon wetland functions. Silviculturists on the Tongass National Forest have concluded that no short-term loss of wetland function on harvested forested wetlands has occurred during the past 20 years (USDA Forest Service 1995). However, Kissinger et. al. (1979) suggests that timber harvest on wetlands of south Kuperanof Island has resulted in stunted second-growth forest stands.

This issue of timber productivity on forested wetlands on certain soil types was addressed in the Tongass Land Management Plan Record of Decision (TLMP ROD 1997). The TLMP ROD directed the Forest Service to avoid harvesting timber on the Kaikli, Karheen, Kitkun, and Maybeso soil series, because the scientific information related to the effects of timber harvesting on these soils is incomplete. A scientific study which assesses the effects of timber harvest on these wetland soils is currently underway. This direction is to be given the full force and effect of Forest Plan Standards and Guidelines and has been applied in the Sea Level Project Area. Timber harvest has been deferred on areas where Kaikli and Maybeso soils have been identified. These soils are more poorly drained and typically have a lower timber site productivity than other forested wetland soils. Other soil series found in forested wetlands, including the Helm and Hofstad series, tend to have better drainage, have not been deferred from harvest and are included in a number of units.

Best Management Practices designed to minimize effects upon water quality also minimize the effects of timber harvest and road construction on wetlands. Full suspension of logs and other low impact yarding systems minimize disturbance of wetland vegetation, as well as surface and subsurface hydrology. Timber harvest is expected to have minimal long-term effects upon the physical, chemical, and biological functions of wetlands.

The most biologically valuable wetlands—estuarine meadows, tall sedge fens, and riparian forests—will be minimally affected by the proposed action. Transportation facilities and timber harvest units are designed to avoid or minimize the effects upon these valuable wetlands. Best Management Practices and mitigation measures are applied to protect wetland resources (see Chapter 2 and the Unit Cards in the Sea Level Record of Decision). Wildlife habitat values of forested wetlands may be affected by timber harvest by altering the forest structure. Virtually all of the proposed timber harvest in this project takes place on low value forested and subalpine forested wetlands.

Approximately 50 percent (45,948 acres) of the Project Area is classified as wetlands. An estimated 53 percent (24,480 acres) of these forested wetlands currently supports commercial forest stands. Many of the wetlands on the Project Area do not support commercial or economic stands of timber and are not scheduled for harvest in this or future plans. Larger muskegs supporting no commercial timber will not be harvested, but may be affected by yarding operations within the unit. Table Floodplains and Wetlands-6 presents data on proposed harvest on wetlands by alternative. Alternative 2 harvests the most acres. Alternatives 7 and 5 rank second, and third, respectively, in terms of the most acres of forested wetlands proposed for harvest.

Timber harvest on forested wetlands involves manipulation of the vegetation, which temporarily changes the hydrology of the site. Patric (1966) suggests an increase in water yield may result from timber harvest. A temporary increase in soil moisture is expected until vegetation is established.

Timber site productivity on wetland soils is typically lower than on better drained soils. Growth rates on wetland sites are expected to be slower than nonwetland sites, and rotation lengths may be slightly longer than 100 years. Areas where slow growth is expected range from 914 acres in Alternative 2, to 309 acres in Alternative 5.

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Table Floodplains and Wetlands-6
Road Construction and Timber Harvest Activity on Wetlands by Alternative

	Watershed				
	Calamity Creek	Painted Creek	Sea Level Creek	All Other Watersheds	Total
Alternative 1					
Road Miles	0	0	0.0	0.0	0.0
Timber Harvest Acres	0	0	0.0	0.0	0.0
Alternative 2					
Road Miles	0	0	6.1	28.6	34.7
Timber Harvest Acres	64	54	160.0	636.0	914.0
Alternative 5					
Road Miles	0	0	1.2	21.5	22.7
Timber Harvest Acres	0	0	0.0	309.0	309.0
Alternative 7					
Road Miles	0	0	1.3	21.1	22.4
Timber Harvest Acres	0	44	44.0	468.0	556.0

Source: Babik 1998.

Notes: Most of the proposed timber harvest occurs on the low-value, forested and subalpine forested wetland types; small areas of other wetland types may be included in some harvest units.

Road construction will occur mainly on low- and medium-value wetland types.

New road construction on wetlands will be limited to the needed transportation components of roads, landings, and drainage structures. Best Management Practices will be used, especially with regard to the use of wetlands as filter strips to capture sediment. Ditch construction will be minimized on open muskegs to the extent consistent with minimizing sediment production and water accumulations on the road surface. Roads through wetlands can affect the flow of water in the wetland. Placement of culverts and other road drainage features will ensure that flow and reach of water in the wetland are maintained at a natural level. Impacts from roads will be limited to the wetland directly underlying the road prism and associated cuts and fills.

Rock overlay construction on wetlands covers the vegetation, but provides a highly permeable fill that minimizes changes in hydrologic conditions. No changes in chemical conditions are anticipated.

Application of BMPs during construction will assure that waterflow, circulation patterns, and chemical and biological characteristics of the water within wetlands will not be impaired. Additionally, use of BMPs will assure that adverse impacts to the aquatic environment will be minimized. In terms of terrestrial environment, wildlife use of wetlands for travel-ways and predation may be reduced during periods of vehicular traffic on the roads.

Timber Harvest on Wetlands

The indirect effects of road building and logging of forested wetlands within watersheds over time are another concern. The assumptions described in the following list will be used to assess these effects.

- The suitable timber base will remain the same. All analysis will be based on the operable timber within the Value Comparison Unit (VCU).
- Standards and guidelines for harvest and road construction activities will remain constant over the life of the project.
- Future accessibility of timber in relation to wetlands will be similar to the accessibility encountered in this sale.
- Distribution of wetlands is similar in all VCUs.

Prior to 1998, approximately 12,220 acres of timber were harvested in the Project Area. Approximately 250 of those acres (2 percent), are forested wetlands. During the Project operating period (1998-2007), between 0 and 914 acres of forested wetlands are scheduled for harvest, depending on alternative (see Table Floodplains and Wetlands-6). Implementation of Alternative 1 would result in a continuation of the existing condition.

Indirect Effects of Roads on Wetlands

Prior to 1998, approximately 20 miles of road have been constructed over wetlands in the Project Area. This equates to less than 1 percent of all wetlands within the Area. Alternative 2 would result in the construction of 35 miles of roads on wetlands within the Area by 2007 (Table Wetlands-6). Implementation of Alternative 5 would result in the construction of 23 miles of road by 2007. Clearing limits of 75 feet along proposed roads are assumed for this analysis. Actual road design will vary. Specified roads will typically include a road surface of approximately 16-foot width and a varying width roadside ditch and/or fill-slope, depending upon slope, topography, soil type, and drainage. Typically, wetlands occur on relatively gentle slopes which require a minimum of clearing, excavation, filling, and ditching.

Cumulative Effects

Floodplains, and Wetlands

By 2140, within the Project Area, approximately 37 additional acres of floodplains, and 7,730 acres of forested wetlands will be harvested. The product of uneven-aged management, these areas support a mosaic of all-aged stands and even-aged stands of varying age classes. About 60 total miles of roads will have been constructed on wetlands. These management activities will incorporate the TLMP (1997) standards and guidelines. By maintaining floodplains, and wetland values and functions in the upcoming decades, the cumulative effects of these actions will remain within acceptable levels.

Forest Health

Key Terms

Endemic—peculiar to a particular locality; indigenous.

Epidemic—rapid spread or sudden prevalence of a disease.

Phloem—the tissue in plants that conducts foods such as sugar.

Xylem—the tissue in plants that conducts water and substances in solution.

Sapwood—the softer part of wood, between the inner bark and the heartwood which conducts water up to the leaves.

Affected Environment

Forest insects and diseases are normal components of the forested sites in the Sea Level Project Area. Some of them exist, and will continue to exist, at endemic levels. Even at low levels of infestation or infection, forest insects and diseases have considerable effects on forest dynamics and resource management values. When they proliferate and become epidemic, the consequences to the forest can be dramatic. Currently there is no indication that insects or diseases are a potential problem in the Sea Level Project Area.

Insects

The two most common types of destructive insects found in the Sea Level Project Area are defoliators and bark beetles.

Forest Defoliators

Forest defoliators eat the leaves or needles of forest trees. Unlike bark beetles, defoliators usually do not kill trees, but slow down tree growth and increase susceptibility to secondary attack by other insects and diseases. All species of trees are not equally susceptible to injury from defoliation. Hardwood species can usually withstand several years of defoliation because they store large food supplies and can refoliate in the same year. Conifers, on the other hand, may be killed by a single defoliation if it occurs prior to bud formation in midsummer.

The two most common forest defoliating insects that occur within the Project Area at endemic levels include the following:

Black-Headed Budworm

Black-headed budworm, *Acleris gloverana* (Wals) is one of the most destructive forest insects in coastal Southeast Alaska. In the 1950s, almost one-third of the net timber volume was lost on some hemlock sites due to budworm defoliation. Larvae usually confine their feeding to new growth. In large concentrations, the larger larvae will feed on older needles. Budworm defoliation can result in growth reduction, top-kill, and, at times, tree mortality. Budworm populations are characterized by sporadic spectacular increases followed two to three years later by equally rapid declines.

Hemlock Sawfly

Hemlock sawfly, *Neodiprion tsugae* (Middleton) is a serious defoliator of western hemlock throughout Southeast Alaska. Outbreaks tend to be more severe and of longer duration in the area south of Frederick Sound, especially along Clarence Strait. Larvae feed on mature foliage rather than the current year's foliage. Most sawfly outbreaks do not cause tree mortality, but some trees are top-killed and radial growth may be reduced. Tree mortality

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becomes more likely when sawfly and black-headed budworm populations coincide. This is due to the feeding habits of the two defoliators; the budworm feeds on the current year's foliage, whereas sawflies consume previous year's foliage. Natural controls usually reduce epidemic sawfly populations within a few years. Wetter than normal summers help reduce sawfly populations by favoring conditions for fungal growth. Fungi readily infect and kill sawfly larvae under warm, damp conditions. Low summer temperatures can also delay sawfly development and reduce the opportunities for successful egg laying. Eventually starvation and poor nutrition brought about by depletion of the host foliage will also contribute to the population collapse.

Bark Beetles

Bark beetles are probably the most destructive forest insect in Alaska. Bark beetles prefer to breed in weakened host material. However, during favorable climatic periods for beetle development, populations may build up rapidly and healthy trees are successfully attacked. Bark beetles girdle the phloem which, in turn, disrupts the downward movement of nutrients. Some bark beetles, notably those of the genus *Dendroctonus*, have a symbiotic relationship with blue-stain fungi. The blue-stain fungi can completely penetrate the sapwood within a year. The fungi plug up the outer conducting tissues in the xylem which halts upward water movement. This action, plus that of the bark beetles, can cause the death of a host tree.

Spruce Beetle

Spruce Beetle, *Dendroctonus rufipennis* (Kirby) outbreaks have been noted across the Tongass National Forest and adjacent lands in previous years. The spruce beetle life cycle is 2 years, with adult beetles emerging in late May to early June in search of susceptible host material (spruce logs). Dispersing adults can fly for long distances, over 7 miles nonstop. Adult mortality during dispersal is quite high. Female beetles are attracted to windthrow and other downed material. Beetles prefer to attack the sides and bottoms of downed material because of favorable temperature and moisture regimes for brood development. Males are attracted to the site via airborne chemicals produced by the female beetles.

Most outbreaks originate in blowdown or logging residuals (cull logs) and spread to adjacent standing timber. Mortality in unmanaged Sitka spruce stands varies and can be as high as 75 percent.



Diseases

Some of the more common diseases and other forms of damage are discussed below.

Hemlock Dwarf Mistletoe

Hemlock Dwarf Mistletoe, *Arceuthobium tsugense* (Rosendhal, G. N. Jones) is a destructive disease of western hemlock throughout the Project Area. Infestation levels vary in old-growth hemlock stands. Dwarf-mistletoe is absent in some stands and in other stands almost every hemlock is infected. The volume of western hemlock trees heavily infected with dwarf-mistletoe can be reduced as much as 50 percent over a 100-year period. Dwarf-mistletoe is species specific and rarely infects Sitka spruce and mountain hemlock.

The spread of dwarf-mistletoe in young hemlock stands is often the result of leaving standing infected hemlock in cutover areas (TLMP 1997). Dwarf-mistletoe responds to light with increased seed production. Rates of spread to adjacent and lower canopy trees will increase in partial cuts where infected hemlocks remain.

Other

Alaska Yellowcedar Decline

Alaska Yellowcedar Decline, which leads to reduced growth and eventual death of Alaska yellowcedar, is a widespread problem throughout the Project Area. This decline is associated with wet, poorly drained sites, and recent research has demonstrated that the primary cause of decline cannot be attributed to any contagious organism (TLMP 1997). Since it is not contagious, Alaska yellowcedar decline will not spread to sites where it is not found now (TLMP 1997). Because Alaska yellowcedar has high timber value, this annual mortality represents a significant loss in timber value. In addition, substantial acres of old-growth cedar forests have been harvested and are regenerating to other species. The regeneration of Alaska yellowcedar needs to be specifically considered where it forms a significant component of a site proposed for harvest.

Hemlock Fluting

Hemlock Fluting results in deeply incised grooves and ridges that extend vertically along the trunk of the tree. This condition reduces the value of hemlock logs because they yield less sawlog volume and because some of the milled wood contains bark. The cause of hemlock fluting is not completely known but is believed to be genetically controlled. Some sites are heavily affected, to the point of making the stand unsaleable, while other sites have relatively light or no damage.

Decays

Decays that affect the stem and root systems are probably the major cause of volume loss within the Project Area. Many decay fungi enter through tree wounds. The accidental wounding of trees during partial cuts and commercial thinnings will increase the impact from decay organisms in managed stands.

Trees are susceptible to a sequence of diseases at different stages of their growth. Early susceptibility thins a forest stand resulting in more vigorous crop trees. In turn, late susceptibility removes the older and more decadent trees, making room and preparing the way for new trees.

Effects of the Alternatives

Specific pests will be affected differently by each of the alternatives. In general, increasing timber harvest will decrease the impacts of the spruce beetle and timber volume loss by pests such as wood decay fungi and hemlock dwarf mistletoe. From the perspective of timber management, the health of the forest is increased through timber harvesting. However, many of these pests also contribute significantly to ecosystem diversity and long-term stability in old-growth stands by providing increased canopy diversity and animal habitat, and by causing the formation of small scale gaps.

In general, endemic levels of insect and disease activity in mature and overmature forests will be allowed to run their course. Tree losses will be accepted. Salvage logging that exceeds the intent of "minor changes" as defined under the timber sale contract and/or direct control measures will require additional NEPA analysis prior to implementation. The action alternatives all have the same relative environmental consequences from a pest management standpoint regardless of whether viewed from a timber production or a biodiversity perspective.

The previous statement is true as long as the range of silvicultural systems applied remains constant across all alternatives. Partial cuts that retain overstory trees can result in western hemlock (the most tolerant species) forming a much larger percentage of the future stand composition. Sitka spruce, western redcedar, and Alaska yellowcedar occurrence in these sites would be greatly reduced. Partial cutting would increase dwarf-mistletoe infection. Unless a large investment were made to sanitize the stand (remove infected trees) periodically, the future value of the site for timber production could be reduced from an economic standpoint.

Geology, Minerals, and Cave Resources

Key Terms

Carbonate rock—rocks, such as limestone and marble, which contain a high content of calcium carbonate, CaCO_3 .

Cirque—a circular basin, a natural amphitheater formed at the head of mountain valleys by glacial erosion.

Diorite—a granular igneous rock made up of mainly feldspar and hornblende.

Epikarst—the surface of the karst. It is intensely dissolved veneer consisting of an intricate network of intersecting dissolution-widened fissures, cavities, and tubes.

Fjord—a long, narrow arm of the sea, bordered by steep cliffs, formed by glacial erosion.

Gabbro—a granular igneous rock made up of mainly dark-colored minerals, labradorite and augite.

Glacial till—gravel, boulders, sand, and finer materials transported and deposited by a glacier.

Graywacke—fine-grained, sedimentary rock made up of fragments of slate or schist.

Isocline—a fold of geologic strata so tightly compressed that the parts of each side dip in the same direction.

Karst—a type of topography that develops in areas underlain by soluble rocks, primarily carbonate rocks such as limestone. Sinkholes and caves are formed when the subsurface layer dissolves.

Lithology—the science dealing with the mineral composition and structure of rocks.

Phyllite—a slaty rock with lustrous surfaces due to the high content of mica flakes.

Pleistocene—the epoch forming the first half of the Quaternary period, originating about one million years ago.

Affected Environment

The geology of the central part of Revillagigedo (Revilla) Island affects all of the area's other physical and biological characteristics. The geological characteristics of the Project Area may be described by the geomorphological, lithological, and structural geology.

Geomorphology

The Sea Level Project Area has been heavily modified by Pleistocene and post-Pleistocene glaciation. The Project Area is characterized by fjords, glaciated valleys, and ridges that trend in an east-west direction from the former centers of glacial origin in the mountains to the east. The features characteristic of glaciated coastal areas are easily recognized in the Project Area. Southeast Alaska has one of the best developed fjord systems in the world with deep sea channels, such as Carroll Inlet and Thorne Arm, carved to great depths by coastal glaciers. The steep topography adjacent to the shore in much of the Project Area does not provide good sites for log transfer facilities (LTFs) and other shore access developments. One of the most striking characteristics of a well-developed glaciated valley is the U-shape of its cross profile, with a nearly level valley floor, filled with glacial debris, and considerably over-steepened side-walls, approaching vertical in places. Terrain of this nature typically has good sites for the growth of commercial tree species on the valley floor and lower sideslopes. The valley side-walls are usually difficult to access and much of this extremely steep ground is

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unsuitable for the production of commercial wood products. The Calamity and Marble Creek valleys are examples of glacial influence. The surrounding ridge-tops, with their rounded profiles and relatively low relief, are characteristic of areas overridden by glacial ice. These ridge-tops are often above tree-line or are relatively wet sites which do not support stands of commercial timber. While road construction on many of these ridges would be relatively easy, access from the valley below is difficult. Painted Peak, in the Shoal Cove area, is the remnant of a volcanic cone. The surrounding landscape, especially to the south, is carpeted by a layer of volcanic cinder and ash, ranging to tens of feet in thickness. Karst terrain is also scattered across this landscape, typically occurring in narrow strips, particularly in the Calamity and Marble Creek valleys.

Lithology

The lithology or bedrock geology of the central part of Revilla Island consists mainly of a group of metamorphosed and deformed rock strata including dark-gray slate, phyllite and graywacke, marble, andesitic or basaltic volcanic rocks, conglomerates and inclusions of gabbro, and diorite. Running through these bedded rocks are locally abundant dikes and sills of granodiorite and quartz-diorite. While the masses of gabbro and diorite which make up the core of these mountains form relatively stable structures, the slates, phyllites, and graywackes which overlay or are adjacent, form landscapes susceptible to landslides and other erosional processes. Much of the area around, and to the south of Painted Peak is blanketed by relatively recent deposits of volcanic ash. These deposits have been locally quarried and used for road surfacing in the Shoal Cove area. Marble and quartz-diorite probably make the most competent road surfacing material in the Project Area. The gabbro and diorite are typically less competent. Slates, phyllites, and graywackes break down rapidly into fine material when used on road surfaces. Narrow bands of carbonate rock, marble and limestone occur in the Project Area, particularly in the Calamity and Marble Creek valleys. All of these rocks are adequate for base material, although the quartz-diorite and granodiorite are often difficult to reduce into proper sized material.

Structural Geology

The geologic structure of the Project Area consists mainly of a series of southwest trending, overturned isoclinal folds that are cut by high-angle faults. The bedded nature of the slates, phyllites and graywackes that make these isoclinal folds, particularly when oriented parallel to the ground slope, provide failure planes that facilitate landslides and other slope failures. Numerous minor faults give the landscape much of its characteristic structure, with numerous parallel, acutely, and obtusely intersecting drainage features.

Minerals

Minerals are legally divided into three groups: locatable minerals, leasable minerals, and saleable minerals.

Locatable Minerals

A locatable mineral is any mineral which is "valuable", in the usual economic sense, or has a property that gives it distinct and special value. Examples of locatable minerals on the Tongass National Forest are gold, silver, copper, molybdenum, iron, nickel, lead, and zinc. There are historic mines located within the Project Area near the mouth of Sea Level Creek. The potential for location and development of locatable minerals in the Project Area appears to be low (Coldwell 1989).

Leasable Minerals

Federally-owned leasable minerals include oil, gas, coal, geothermal resources, potassium, sodium, phosphates, and sulfur. Presently, there are no leasable mineral applications or pending applications, prospecting permits, or geophysical exploration permits on the Project Area. No leasable mineral commodities are presently being produced on the Tongass National Forest. The anticipated demand for leasable minerals is expected to remain low. There are no known geothermal areas in the Project Area, although the Bell Island hot spring is located just to the north of Revilla Island.

Saleable Minerals

Saleable, or "common variety", minerals include sand, rock, building stone, gravel and other similar materials. The predominant saleable commodity in the Project Area is crushed rock used to construct roads. There are also deposits of sand and gravel throughout the area.

Cave Resources

Carbonate rock, limestone and marble occur within the Project Area at a number of locations. The main occurrences include the Calamity and Marble Creek valleys, the North Saddle Lakes vicinity, Elf Point and Eve Point areas (Berg 1988). Karst features on this landscape are relatively small in scale and very localized in occurrence. Where the carbonate rock is found, dissolution features typically are found in association with it.

Potential karst lands within the Project Area were first identified with the use of geologic maps (Berg, 1988). Geologic units which consist primarily of carbonate rock were considered to be potential karst lands. An inventory of karst landscapes and cave resources was conducted during field reconnaissance of the Project Area. Volunteers from the Glacier Grotto, a local chapter of the National Speleological Society, located and mapped several caves and sink holes in the upper reaches of the Calamity Creek watershed in the vicinity of a proposed harvest unit. The presence of karst features and the degree of development was recorded. An assessment of the vulnerability of identified karst terrain to management activities was made. All karst lands in the Project Area were determined to be within the low to moderate vulnerability classes, as defined by TLMP, 1997.

There are caves located within the volcanic ash deposits in the Painted Peak area. At least two caves are located within the vicinity of proposed timber harvest units. The Glacier Grotto explored and mapped these unique features as well. These caves have been eroded in steep slopes or cliffs, typically above stream courses. More detailed information on these caves is described in the individual Harvest Unit and Road Cards in the Sea Level Record of Decision.



Effects of the Alternatives

Geomorphology

None of the alternatives will have an effect on the geological characteristics or cave resources of the Project Area.

Minerals

The proposed project will have minimal effect upon the locatable and leasable minerals within the Project Area. Expansion of the present transportation system could open more areas for exploration or facilitate future development.

Alternatives 2, 5 and 7 will develop sources of saleable mineral material, crushed rock, for use in the construction of roads throughout the Project Area. Future demand for common varieties of mineral materials in the Project Area is anticipated to remain low.

Cave Resources

The potential for identifying additional significant cave resources within the karst landscape of the Project Area during implementation is low. The harvest unit with identified caves and sink holes has been deferred and is in none of the action alternatives. Alternative 2 includes timber harvest on 379 acres of low vulnerability karst lands. Alternative 7 harvests timber on 176 acres of low vulnerability karst lands. There are caves located within the volcanic ash deposits in the Painted Peak area. At least two of these ash caves are located in the vicinity of proposed timber harvest units. These caves were mapped by volunteers from the Glacier Grotto as well. Appropriate mitigation measures, as outlined in the TLMP (1997) Karst and Caves Standards and Guidelines, will be applied during harvest unit layout where cave resources that may be affected by the proposed activities have been identified. The results of field reconnaissance and site specific mitigation measures are described in the Harvest Unit and Road Cards in the Sea Level Record of Decision.

Other Resources

Successful regeneration of commercial tree species on areas underlain by carbonate bedrock has been expressed as a potential concern in the Project Area. This concern is based upon a belief that shallow soils, formed on carbonate bedrock, become droughty and incapable of supporting regeneration following timber harvest. In the Project Area, even a complete loss of soil and litter from the surface of the carbonate rock would not prohibit the re-establishment of a forest, as surface materials are retained within the epikarst channels (Harding and Ford 1993). Regeneration surveys, conducted over the past couple of decades in the Project Area, have not indicated any regeneration failures in second-growth stands underlain by carbonate bedrock. Epikarst features are not highly developed in these areas, and the soils that form are typically deep, with adequate moisture holding capacity to support a regenerating forest stand.

Land Adjustments, Uses and Permits

Key Terms

Alaska Native Claims Settlement Act (ANCSA)—provides for the settlement of certain land claims of Alaska Natives.

Encumbrance—a claim, lien, charge, or liability attached to and binding real property.

Native selection—application by Native corporations to the USDI Bureau of Land Management for conveyance of a portion of lands withdrawn under ANCSA in fulfillment of Native entitlements established under ANCSA.

Special use permits—permits and granting of easements (excluding road permits and highway easements) authorizing the occupancy and use of land.

State selection—application by Alaska Department of Natural Resources to the USDI Bureau of Land Management for conveyance of a portion of the 400,000-acre State entitlement from vacant and unappropriated National Forest System lands in Alaska, under the Alaska Statehood Act.

Affected Environment

Land Status

Prior to 1971, the Tongass National Forest, Ketchikan Administrative Area land ownership pattern had not changed significantly, with only minor changes taking place as National Forest System lands were transferred to private home sites, canneries, and townsites. Beginning in the early 1970s, land ownership changes were made as a result of legislation, including the Alaska Native Claims Settlement Act (ANCSA) and the Alaska National Interests Land Conservation Act (ANILCA). Within the Sea Level Project Area there are lands being used under special use permits.

State Selections

The State of Alaska, under the Statehood Act of 1959, is entitled to select up to 400,000 acres from the National Forests in Alaska. As of November 1997, 100 percent of the entitlement in the Project Area has been conveyed. Most of the remaining acres have been selected and are in the process of being conveyed by the Bureau of Land Management. Because the State of Alaska was granted the opportunity to select more lands than they were entitled to receive conveyance, some of these lands may become available for National Forest management in the future.

Private Land

There are 3,182 acres of private land within the Project Area.

Native Selections

Native selections are authorized under 14(h)(8) of ANCSA. On a large portion of the Project Area, approximately 15,200 acres, subsurface (mineral) rights have been encumbered by Sealaska Corporation selection. Title to these subsurface rights have not yet been conveyed, and constitutes an over-selection by Sealaska Corporation.

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Special-Use Permits

A special-use permit has been issued by the Forest Service for specific exclusive uses in the North Saddle Lakes watershed on National Forest System lands. These lands, totalling 920 acres, are under special use permit to the Alaska Energy Authority (AEA) and include those facilities operated by the Ketchikan Public Utilities for the power transmission line from the Swan Lake hydropower site. The U.S. Coast Guard operates a LORAN site at Shoal Cove on National Forest System lands under a Memorandum of Understanding (MOU) with the Forest.

Table Land Adjustments-1 summarizes the special use permit sites in the Project Area.

Table Land Adjustments-1
Summary of Special Use Permit Sites

Name of Permittee	Special Use
AEA*	Power transmission line, 920 acres
U.S. Coast Guard	LORAN site, 55 acres

*Alaska Energy Authority

Mining Claims

There are no known mining claims for locatable minerals within the Project Area. For further information see Geology, Minerals and Cave Resources section of this chapter.

Effects of the Alternatives

Alternatives 2, 5 and 7 will not directly affect the status of existing special use permits or mining claims. Alternatives 2, 5 and 7 may require the issuance of new special use permits for logging camp and log sortyard developments at the Shelter Cove, Shoal Cove and Elf Point LTFs. Alternatives 2, 5 and 7 include timber harvests and road construction on lands encumbered by Sealaska Corporation subsurface rights selections. Alternative 2 includes 11 MMBF of timber harvested on about 382 acres of encumbered National Forest System lands. Alternatives 5 would harvest 7 MMBF of timber on about 258 acres of encumbered land. Alternative 7 harvests 9 MMBF of timber from 312 acres of encumbered land.

Permits and Easements

Alternatives 2, 5 and 7 propose locating timber harvest units or constructing roads near the Misty Fiords National Monument boundary, which would require updated land line surveys. Future conveyance of Native Corporation selections in the Project Area may require the Forest Service to reserve transportation rights-of-way along existing and proposed road alignments on conveyed lands.

Marine Environment, Log-Transfer Sites and Related Facilities

Key Terms

A-frame LTF—log-transfer-facility system which consists of a stationary mast with a falling boom for lifting logs from trucks to water. This system is generally located on a shot-rock embankment with a vertical bulkhead to access deep water, accommodating operations at all tidal periods.

Embankment—rock fill material ranging in size from 1 cubic meter on down to 1 cubic millimeter.

Log transfer facility (LTF)—a facility that is used for transferring commercially harvested logs to and from a vessel or log raft.

Marine benthic habitat—the area occupied by the aggregate of organisms living at or on the bottom of ocean water.

Specified roads—constructed to remain a part of the permanent transportation system.

Affected Environment

Marine Environment

Southeast Alaska's coastline consists of approximately 30,000 miles of tidal shoreline; roughly 60 percent of the total Alaskan coast. Within this region a great diversity of habitats comprise Southeast Alaska's complex estuary and tidal environments.

The intertidal and subtidal marine environments are subject to effects from log transfer and storage facilities; those are the points of concentrated activity associated with the marine transportation of logs. The preferred sites for log transfer facilities (LTFs), log storage areas, camp settlements, and anchorages are deep bays or along straits or channels. These areas are preferred because the deeper water and stronger currents flush out bark and debris that may enter the water, therefore causing less impact to effects on marine life. Other marine areas are not addressed here because they are not expected to be affected by activities associated with the timber harvest of this project.

The shallow marine waters and associated mud flats and estuaries found in the protected coves and bays provide habitat for some important species such as Dungeness crab and juvenile salmon. They are part of a complex and dynamic ecosystem that also includes shrimp, flatfish, marine worms, echinoderms, sponges, sea anemones, shellfish, plankton, marine algae, and other organisms.

Shelter Cove

This LTF is located in an area of steep bluffs rising from the water and continuing down through the intertidal zone to deep water. Most of the substrate is rocks and boulders (from construction of the sort yard area) on top of smooth, natural bedrock. Most of the survey area drops off rapidly to beyond survey depth guidelines with some outcroppings of bedrock protruding through the fill. Bark debris present is a fairly even mix of sizes, from fine debris characterized as sawdust to larger debris composed of bark chips. Chunks and slabs are occasionally present throughout the area, as are scattered branches. The larger chips are more prevalent in front of the bulkhead and graduate outward to finer particles. The marine life community is one primarily associated with a rock substrate. On the natural bedrock surfaces and the new rock fill, encrusting algae and

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invertebrate species inhabit most of the available surfaces. Near the bulkhead, kelp is present in moderate amounts. Where vertical bedrock faces are present, large siliceous sponges are fairly common, as are occasional large patches of compound ascidians. These are filter feeding organisms and have some particulate debris on them but appear to still be healthy. Little fish life was observed on the shallower sample points, but at deeper sample points the rockfish population was active and high. Sea cucumbers were observed in moderate densities. Brittle stars observed on previous surveys were present in low numbers. Several species of sea stars and crabs were observed. In the sand habitat that dominates one of the transects, a few organisms were observed on the surface of the debris including sun stars, moon snails, sea cucumbers, and shrimp. Where bark debris thinned to less than five centimeters, evidence of clams and other benthic fauna were observed.

The steep rocky terrain of this site greatly influences bark accumulation. Instead of a relatively even dispersal throughout the zone of deposit, the cracks, crevices, and dropoffs create a more patchy settlement. This tends to cause debris depth measurements much greater or lesser than a site with even debris settlement, depending on measurement location. Only on a shelf along one of the transects has the bark debris accumulation caused a shift from the natural filter feeding community to one of detrital feeders.

Elf Point

Bottom topography at this site is characterized by a 30 to 40-foot gently sloping shelf that comes to a vertical dropoff to depths greater than the guideline limitation on diving depths. Most of the bark debris observed was located close to the bundle loading area in a narrow band on a bottom slope that is shallow enough for the debris to settle and not slide immediately off. Most of the shelf is relatively light in debris as the slope is steep enough to cause sluffing of the debris. Debris consisted of bark "dust" (particles from approximately four centimeters to fine sawdust-like particles) and splintered pieces of wood and bark, and branches with needles still attached to sunken logs. The marine life community, typical of a rock substrate exposed to a moderate current, appeared to be healthy and diverse. The encrusting organism community on the vertical rock wall appears not to be affected by the small amount of fine bark debris that manages to catch on the organisms as it settles.

Shoal Cove

The underwater topography at this site is characterized by an immediate moderate gradient downward from the LTF. Though most of the natural substrate is covered by bark debris, the adjacent area is a mixture of sand and silt with some shell and gravel. Overall, the character of the bark debris is uniformly small sized. Some larger chips and chunks may be found but the debris is dominated by fine bark dust to small bark chips. The marine life is composed mostly of the species that have colonized the new bark debris substrate. One of the most common organisms found on the debris is the hermit crab, primarily a detrital feeder. The sea cucumber is present in fairly high numbers, whose feeding strategy is appropriate for any substrate. A few sculpins are present. Clam shells are part of the substrate where the debris layer thins out, but no siphons or other evidence of their presence in the bottom at the time of the survey. Sun stars (a major predator of clams) are present in low numbers. The depth of bark accumulation over most of the survey area is significant enough to cause a shift from a benthic feeding community to that of detrital feeding organisms.

Log-Transfer Facilities

The transportation of harvested timber on the Project Area requires that the logs must be trucked or flown to saltwater, transferred to the water (or barges) at an LTF and towed to a sort yard for sorting. They are then moved to processing sites such as the sawmill at Ward Cove or the sawmill at Metlakatla.

Three existing LTFs within the Project Area were constructed between 1960 and 1990. Log Transfer Facilities from the 1960s were modified to meet the current State and Federal permit requirements as part of other activities requiring National Environmental Policy Act (NEPA)

documentation. All LTFs are owned by the Forest Service and are permitted. There are no new sites proposed for this project; only the existing sites will be utilized.

Table Marine-1 displays the existing LTF locations and the decade of construction.

Table Marine-1
Existing LTFs Associated with the Project Area

Location	Number	Latitude	Longitude	Active	Decade of Construction		
					1960s	1980s	1990s
Shelter Cove	1	55 33 25 N	131 21 00 W	Yes			x
Shoal Cove	2	55 27 25 N	131 17 20 W	Yes	x		
Elf Point	3	55 19 10 N	131 13 30 W	Yes		x	

Source: Oien 1998.

Log-Transfer Methods

Two log-transfer methods are considered in this analysis: (1) A-Frame type entry device with rafting facilities (see Key Terms) and (2) a dry land-to-barge transfer facility. The Shelter Cove and Shoal Cove sites are existing A-Frame sites; the Elf Pt. site is an existing land-to-barge site.

A-frame

A modified version of this method uses a stationary A-frame boom with sloping guide rails placed on the bulkhead to guide the logs to deep water at lower tidal levels. The A-frame system requires a minimum of five feet of water at low tide in order to operate. Both A-frame systems allow controlled entry of logs into the water.

Land-to-Barge

The land-to-barge transfer system requires a deep water bulkhead for the barge mooring facility. A minimum of 25 feet of water at low tide is required for barge operations. Logs are loaded directly onto the barge by use of a loader. Barges can also load logs floating in the water with on-board cranes. Most of the sites in the Project Area will be handling small volumes of timber. Conversion of A-Frame sites to barge loading facilities would require moving the bulkhead out to where there would be a minimum of 25 feet of water depth at low tide, requiring substantial amount of embankment fill on the marine environment. Because of high operating costs and the impacts of rebuilding the existing LTFs to accept barges, land-to-barge operations were not considered in the analysis of existing LTF's.

Each LTF requires a log transfer area, operations area, a small airplane and boat dock, an equipment off-loading ramp, and a log raft storage area. The existing sortyard areas at the Shelter Cove and Elf Point LTFs must be expanded in order to accommodate multiple operators that may be using the facility. These facilities are generally located within close proximity to the LTF in order to reduce costs and retain impacts to a localized area.

Logging Camps

The Sea Level Project Area has suitable upland areas for land camps and sort yards. These areas have been established for a number of years and may be used again for this project. The area also contains some protected bays and coves, suitable for float camps. A new area for log sorting near the Shelter Cove LTF will provide additional areas for small operators to sort logs. This area is located on the 8340 road approximately 1/2 mile south of the LTF. The sorting area will require the expansion of an existing rock pit by approximately 25%.

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Float Camps

The number and locations of float camp sites will depend upon the number of logging and road construction contractors engaged in implementing the project. Historical sites are expected to be used. Additionally, camp configuration and type (such as barge or log floats) will influence the location. The operator shall obtain required state and federal permits for camps. A need for sites other than those presently permitted is not expected.

Land Camps

Some previously used land-based camp sites are expected to be utilized. As with float camps, camp configuration will influence the location.

The contractor/operator will be responsible for obtaining appropriate permits for camps in areas other than those already permitted. Solid waste disposal will not be allowed on National Forest System lands.

Effects of the Alternatives

Log-Transfer Facilities

The number of existing LTFs required to harvest the timber scheduled in the action alternatives varies. Table Marine-2 displays the LTFs required for each alternative. No new LTF's are proposed for this project.

Table Marine-2
LTFs Required for the Alternatives

	Alternative		
	2	5	7
Number of LTFs	3	2	3

Source: Oien 1998.

LTFs comply with the Alaska Timber Task Force Siting Guidelines and section 404(B)(1) of the Clean Water Act to mitigate the effects of LTFs on other resources and ecosystems.

Selection Rationale

An inactive LTF at Snipe Point was considered for use on the Project Area. It was dropped from consideration because the cost of reconstruction was higher than the cost of hauling timber to the existing LTF at Shoal Cove.

Types

Log Transfer Facilities can be either low-angle ramps or bulkhead type structures used for transferring logs from trucks to saltwater.

The existing permitted facilities considered in this analysis are bulkhead facilities with a lift-off system and/or barge system. The lift-off system may be either a single or double A-frame. Bulkhead construction ranges in direct impact to the intertidal area from 0.1 acres to 0.25 acres.

Table Marine-3 displays the reconstruction costs associated with each LTF; however it should be noted that these sites were reconstructed during previous silvicultural activities and site development cost is for anticipated maintenance.

Another form of log transfer from land to water is aerial transport of logs from the harvest area directly to water or a barge. This method eliminates the need for truck haul and road development. However, this system is economically prohibitive except in specific situations. None of the alternatives propose helicopter to barge-water operations.

Table Marine-3
Reconstruction Costs Associated with Proposed LTFs

LTF	Number	Transfer Method	Transfer Equipment Cost*	Site Development Cost
Shelter Cove	1	A-Frame	200,000	10,000
Shoal Cove	2	A-Frame	200,000	10,000
Elf Point	3	Barge	0	80,000

Source: Oien 1998.

* Transfer equipment costs are not included in cost of transportation system development costs.

Monitoring of existing LTF's is required yearly for active sites. This involves conducting underwater dives to measure the amount of bark accumulation that has occurred. The sites anticipated for use on this project were found to be within the limits of the permits for each site. A summary of the dive survey results are found Table Marine-4.

Table Marine-4
Summary of LTF Dive Survey Results

Site	Date Surveyed	Number of Sample Points	Acres with Cover	Acres with 100% Cover
Elf Point (Thorne Arm 6)	2/12/95	29	0.30	0.10
Shelter Cove (Carroll Inlet 20)	5/20/97	32	0.36	0.14
Shoal Cove (Carroll Inlet 7)	5/21/97	41	0.52	0.47

Source: Oien 1998.

Marine Benthic Habitat

During the transfer of logs from land to water, bark is sloughed off and may be deposited on the ocean bottom; bark also is continually sloughed off, while the logs are in rafts, by agitation from wind and waves. Bark accumulation on the bottom can diminish habitat for bottom-dwelling crustaceans and mollusks, as well as hamper underwater vegetation used as food and rearing sites for fish and other organisms. All LTFs in the Project Area have been designed to maximize the flushing of suspended bark away from the LTF area to the open sea before it can accumulate on

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the bottom. In 1985, it was determined that discharge of bark into the water at an LTF was a discharge requiring a National Pollution Discharge Elimination System (NPDES) permit.

Marine benthic habitat impacts are expected to be as follows:

Structural Embankment: estimated 0.23 acres affected per site

Site Bark Deposition: 1.0 acre zone of deposition per site

Raft Storage Bark Deposition: unknown

Impacts are displayed in Table Marine-5.

Table Marine-5
Estimated Marine Benthic Impacts (Acres)

	Alternative			
	1	2	5	7
Affected by Structural Embankment	1.38	1.38	1.38	1.38
Affected by Bark	2.00	2.00	2.00	2.00

Source: Oien 1998.

Structural Embankment

All LTF types occupy approximately the same amount of bottom area but in different configurations. For instance, the low-angle ramp system with a 10 percent grade extends approximately 250 feet out into the water on a moderately sloped beach. This system is thus long and narrow. The barge and A-frame systems use more shoreline and do not protrude out into the water as much as the low angle ramp system.

Site Bark Deposition

Two publications describe some of the general effects of LTFs and log storage on the marine benthic habitat. Sedell and Duval (1985) summarize the information available on the effects log transport and storage have on marine resources and fisheries. Faris and Vaughn (1985) examined log transportation and log storage in Southeast Alaska.

Shultz and Berg (1976) examined 32 existing LTF sites and found that 19 had bark accumulation, 8 had no bark accumulation, and 5 had traces of bark. The extent of bark accumulation ranged from 0 to 9 acres for 31 of the 32 sites. The 32nd site had an accumulation of 182 acres that could not solely be attributed to log transfer activities. Faris and Vaughn (1985) reexamined the original data from Shultz and Berg (1976) and found that the average accumulation size was 1.96 acres for all sites excluding the 182-acre site. They speculate that bark and debris accumulation may be decreasing over time due to currents. No estimate was made on the length of time before bark accumulation was completely eliminated.

Faris and Vaughn (1985) also examined the extent of total damage to the marine benthic habitat in Southeast Alaska. Their results indicate that from the 90 currently permitted sites, a total of 176 acres would be affected (using the 1.96 acre average). This is .02 percent of the total estuarine area that is less than 60 feet deep in all of Southeast Alaska. Moreover, when they examined all of the potential area of bark and debris accumulation from all permitted and proposed sites in Southeast Alaska, including all sites considered in the KPC Long-term Sale 1989-1994 EIS, they found that a total of 317 acres would be affected. This is 0.09 percent of

the total estuarine area that is less than 60 feet deep. This result corresponds with the conclusions of Sedell and Duval (1985) that the evidence of damage on important marine populations (bivalves, crabs and salmonids) was inconclusive because of the small area of impact. This evidence resulted in development of the current siting guidelines (e.g., avoiding crab habitat, shallow areas at the heads of bay, etc.) and suggests impacts would be minimal.

The major effect of bark and debris accumulation is on little neck clams and bay mussels which are eliminated when as little as 4 to 5 inches (10-13 cm) of bark accumulates (Freese and O'Clair 1987). Furthermore, Conlan and Ellis (1979) reported mollusks and several polychaetes were eliminated by bark debris thicker than 2.5 cm, and that effects of bark may last several decades. From this evidence, it can be assumed that other plants and animals which live in and on the bottom would probably be at similar risk.

Concentrations of chemical leachates from bark have been shown to be toxic to salmon fry, crabs, and clams. However, these toxic substances can settle in saltwater, and therefore do not appear to be a major problem in open water where good circulation exists (Sedell and Duval 1985). The Alaska Timber Task Force Siting Guidelines for LTFs attempts to mitigate the potential effects of bark dispersal and toxicity by: (1) locating LTFs in areas having the least productive inter-tidal and sub-tidal zones, (2) avoiding sensitive habitats, (3) avoiding shallow water, and (4) providing that LTFs should be located along or adjacent to straits, channels, or deep bays where currents are strong enough to disperse sunken or floating wood debris. Currently, all active LTFs receive a yearly underwater diving and sampling transect as required by the Environmental Protection Agency.

Certain dissolved substances (hydrogen sulfide and ammonia) recently have been shown to occur in open spaces between pieces of bark accumulated on the bottom (O'Clair and Freese 1988). O'Clair and Freese also note that it is not clear whether other toxic substances not measured in the study occur within bark accumulations. These substances do not enter the water above the bark. However, if Dungeness crabs burrow into the bark deposit, it has been demonstrated that their reproductive ability, eating habits, and overall survival can be affected. It should be noted that this type of effect has been demonstrated in only one bark accumulation field (Rowan Bay LTF, Kuiu Island, Southeast Alaska) and that, in general, Dungeness crabs were not found in bark accumulations at a number of other LTF locations. It is not known whether these effects would occur for other burrowing crab species. Since king crabs do not burrow, it is not clear whether this species is affected by bark and debris accumulation at LTF sites.

Raft-Storage Bark Deposition

The other potential effects associated with LTFs are from log rafts and log storage in saltwater. The area under a log raft may be affected by bark accumulations with effects similar to but not as concentrated as those discussed for LTFs. In addition, if the raft is stored in a bay or cove for a long period of time, marine algae may be affected by shading. Occasionally, rafts stored in shallow depths may ground on the bottom. This would cause mechanical disruption or compaction of inter- and subtidal bottom habitats. This would be a short-duration effect because recolonization would begin shortly after the raft refloated, unless the site were repeatedly used and log rafts frequently grounded. Proposed and existing log storage areas in the Project Area are deep enough and are not expected to ground.

Barge LTFs

Barge LTFs probably would have less effect on the marine environment than rafting LTFs, although no studies are available for comparison. The rock bulkhead associated with the facility would be longer and slightly wider at the seaward end. The additional length and width would impact less intertidal area than a rafting LTF bulkhead. The longer length and wider seaward end in deeper water would require dredging and filling in the subtidal area.

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Bark and debris would accumulate only in a small area around the extreme seaward end of the facility.

Helicopter to Log Boom or Barge LTF

Helicopter to a log boom or barge LTF would probably have less effect on the marine environment. Helicopter to log boom would have more impact than to a barge. However, the log boom can also be located in deep water to avoid bark deposition and embankment in the higher-value shallow areas. Helicopter to barge would minimize bark deposition and eliminate embankment in the marine environment.

Fisheries

The effects of LTFs on fisheries resources have not been quantified. It is unlikely that any effects on returning anadromous fish would occur unless a LTF and raft storage area caused blockage of a stream entrance. Juvenile pink and chum salmon that spend several months, immediately after out-migration, in protected bays and coves would be more likely to be affected by log-transfer activities. These small fish are highly mobile as they feed on marine invertebrates. Some of their preferred food items live on the bottom surface. Bark accumulation and the area under the embankment of a standard bulkhead eliminates a small portion of the habitat of those food items but is unlikely to cause measurable adverse consequences.

It has been hypothesized that the breakwater usually associated with a LTF structure, regardless of whether a raft or barge, can cause greater mortality of pink and chum juveniles because they are forced to move into deeper water where more predators consume them. It is not known whether this is a major source of mortality in addition to the naturally low survival rate attributed to early marine life stage of juvenile pink and chum salmon. Because barge LTFs require longer breakwaters, the probability of this effect may be increased.

There is no formal documentation that LTF structures or activities associated with their use, conflict with commercial fishing near the facility. If a facility were located in a small bay or cove, it is possible that there could be some difficulty maneuvering around log rafts or moored barges to get to favored fishing sites. No adverse consequences on commercial fishing or subsistence uses or marine resources are anticipated as the result of LTF location.

Camps associated with a LTF site can cause additional use of fisheries and marine sources. There is no data currently available on the amount of additional use occurring at various camp locations in the study area. The competition for resources at or near logging camp locations would probably increase. There is currently little or no information to indicate that resource allocation problems have occurred as the result of a logging camp. The Board of Fisheries and Game (Alaska Department of Fish and Game) can control the amount of harvest by setting bag limits, shortening season lengths, or by instituting a complete closure of a fishery. If resource problems arise because of increased resource pressure due to a logging camp, the Forest Service would aid the Alaska Department of Fish and Game in attempting to resolve the problem. However, it is unlikely that utilization would progress far enough to cause adverse consequences on the fisheries or marine resources.

Wildlife

From a wildlife perspective, there are two types of effects associated with a LTF and camp. First, there is the potential loss of habitat due to clearing for the camp, sort yard, and associated facilities. The amount of habitat lost is relatively minor. Whenever possible, camps and sort yard facilities are located away from the highest quality habitat. The differences between a slide facility and barge facility are inconsequential. The objectives are to avoid eagle nest sites and estuarine habitat. The second type of effect is, disturbance as a result of increased human activity associated with the camp. The overall effects of disturbance of wildlife-use patterns are generally minor. Most wildlife species adapt to

increased human activity but will be effected by increased hunting, and increased bear-human encounters.

An increase in the number of people in an area would generally increase the harvest levels, however, they can be monitored and regulated. The influx of additional people into an area appears to have a greater potential to affect the existing users of the area than wildlife populations.

For additional information on the effects of the proposed alternatives on existing users, see the ANILCA, Section 810, Subsistence Evaluation and Finding in the Subsistence section of this chapter.

Visual Resources

The large size, linear bold shape, and saltwater location of LTFs generally dominate the landscape when viewed within the foreground distance (less than ¼ mile). Their relatively low profile, however, helps mitigate the negative visual impacts when viewed from the middleground (¼ mile to 5 miles). Because the sort yards and land camps are located on level or gently sloping grounds, as opposed to steeper hillslopes, there is less visual impact from a saltwater viewpoint.

There is one new sort yard area considered in all of the alternatives for this Project Area. It is expected that most camps will be floating. Accordingly, upland development will consist of structures such as maintenance shops and fuel storage tanks. These facilities should have minimal permanent visual resource impact.

Long-Term Productivity

The short-term effects of developing LTFs in the intertidal area can be compared to the value of long-term accessibility for timber management in the area. Without a way of transferring logs into saltwater, the long-term opportunity to manage the uplands for commercial timber is lost. If LTFs were not available for use, the volume accessible by those facilities would not be available to meet Forest Plan direction.

It is assumed that other resources would have similar management opportunities with or without access to the uplands from saltwater (by an LTF). Table Marine-6 compares the number of acres potentially affected by each LTF to the number of acres of suitable timber harvest for each location.

Short-term use of 4.14 acres of estuarine habitat, all of which occurs in large estuaries, would provide access to 91,000 acres of land suitable for timber production. This roughly equates to 88 million board feet to be available to meet goals set by the Ketchikan Area timber sale program.

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Table Marine-6
Comparison of Short-Term Impact on the Estuarine System to Long-Term Harvest (Year 2055)

LTF	Value Comparison Units Served by LTF for the Sea Level Project	Estimated Acres of Impact on the Estuarine System	Acres of Potential Long Term Harvest
Shelter Cove	746, 753	1.38	38,000
Shoal Cove	746, 753, 756	1.38	37,400
Elf Point	755, 757	1.38	16,400
Total	N/A	4.14	91,000

Source: Oien 1998.

LTF Use

The volume of timber to be transferred to water varies by alternative. The effects of bark deposition will vary as well in proportion to that volume watered at each LTF. In any event, expected zones of deposition will not exceed that of each LTF's permit. Table Marine-7 displays anticipated timber volumes to be handled at each LTF in each of the action alternatives.

Table Marine-7
Comparison of Sea Level Timber Volumes (MMBF)* by LTF and Alternative

LTF	Alternative		
	2	5	7
Shelter Cove	18	9	15
Shoal Cove	36	14	22
Elf Point	19	0	12

Source: Griffin 1999.

* figures are rounded and do not include ROW volume.

Old Growth and Biodiversity

Key Terms

Biodiversity—the variety of life and its processes.

Canopy—the middle and uppermost layers of foliage in the forest.

Corridor—a patch or strip of habitat linking or providing connectivity between larger patches.

Edge—boundary between two distinct ecosystems, such as between forest and muskeg.

Forage—to search for food.

Fragmentation—reducing the size and connectivity of habitat patches; the degree and impacts of fragmentation depend on scale (in space and time) and the life requirements of the affected species.

Patch—an assemblage of similar vegetation, such as old-growth forest.

Planning area—for the purpose of analyzing viable populations, the planning area is the ecological province, i.e., Revilla Island/Cleveland Peninsula.

Snag—standing dead tree.

Viable population—a population with the estimated numbers and distribution of reproductive individuals to maintain the population over time.

Wildlife Analysis Area (WAA)—a division of land designated by Alaska Department of Fish and Game (ADF&G) and used by the USDA Forest Service for wildlife analysis.

Affected Environment

Old-Growth Forest

Most of the commercial forest land (CFL) in the Tongass National Forest that has not been previously harvested has been undisturbed for centuries and is considered old growth. The definition of old-growth forest varies by habitat and includes such factors as age and size of trees, spacing, snags, canopy layers and structure, and the amount of down (on-the-ground) material (USDA Forest Service 1991a).

Old-growth forest is also important as wildlife habitat for old-growth associated species such as Sitka black-tailed deer, marten, black bear, Vancouver Canada geese, and cavity or snag-dependent species such as flying squirrels, woodpeckers, and owls. Many species use the structural attributes of old-growth forests. The combination of a dense canopy with scattered small openings (typically 20 to 40 feet across) allows forage growth under openings, while the large limbs within the canopy intercept enough snowfall to provide winter food and thermal cover for deer and other species. The large, dense stems also provide some measure of thermal insulation in the winter, as well as during cold rains in the spring and summer. Large dead or defective trees become nesting sites for marten, owls, eagles, wrens, and chickadees, as well as feeding sites for woodpeckers, sapsuckers, brown creepers, and others.

The value of old-growth forest for wildlife habitat is also thought to transcend individual stands. Large, contiguous, unfragmented blocks of old-growth forest are important to forest interior species, such as the northern goshawk and marbled murrelet. The large old-growth blocks provide expansive hunting territories and protection from predators, and promote genetic mixing among populations that would be less likely to breed if they were spatially

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Biological Diversity and Fragmentation

separated by forest fragmentation. Deer use these large old-growth blocks for migration routes between winter and summer ranges.

National Forest Management Act (NFMA) regulations define diversity as the distribution and abundance of different plant and animal communities and species. Biological diversity, or biodiversity, refers not only to the variety of organisms in an area; it also includes their genetic composition, the complex pathways that link organisms to one another and to the environment, and the processes that sustain the whole system. Biodiversity plays a key role in how well an ecosystem functions. It can be evaluated at different scales, ranging from genetic diversity to landscape diversity.

Biological diversity on a landscape scale is affected by habitat fragmentation. Fragmentation occurs whenever a large continuous habitat is transformed into smaller patches that are isolated from each other, such as occurs from catastrophic windstorms or from extensive clearcutting. The changed landscape functions as a barrier to dispersal for species associated with the original habitat. These smaller and more isolated habitats also support smaller populations, which are more vulnerable to local extinction.

Within and immediately adjacent to the Project Area are large, roadless blocks (Table Old Growth-1) as identified in the roadless inventory in the TLMP Final EIS (1997). The South Revilla block (No. 523) is partially included in the south end of the Sea Level Project Area. The Sea Level Project also includes portions of the North Revilla block and the Carroll block. Both the South Revilla and the North Revilla blocks are adjacent to the 2.1 million acre Misty Fiords National Monument. For more information on roadless areas, see the Roadless Area discussion in the Recreation section of Chapter 3.

Table Old Growth-1
Roadless Areas and Acreage Within and Adjacent to the Sea Level Project Area

Roadless Area* Number	Roadless Area Name	Roadless Area Acreage
523	South Revilla	52,209
526	North Revilla	217,818
535	Carroll	11,671
	Misty Fiords National Monument**	234,930
Total		516,628

Source: TLMP 1997.

* These roadless areas are Forest Plan, not Rare II Roadless Areas (See Appendix E, TLMP Final EIS (1997)).

** Misty Fiords National Monument acreage represents only the acres on Revillagigedo (Revilla) Island.

Prior to timber harvest (1954), the Project Area contained extensive amounts of unfragmented forest patches. Approximately 81 percent of the old growth throughout the Project Area was in forest patches greater than 1,000 acres (Table Old Growth-2). Past timber harvest has decreased the acreage in this patch size class from 26,412 acres to 5,695 acres (Table Old Growth-3, existing condition). The 1,000+ acre blocks currently (1997) comprise 32 percent of the total old-growth blocks. Smaller block sizes have increased as the total old growth available has decreased. Total old growth has been reduced by 46 percent from 1954 conditions.

Table Old Growth-2
Acreage of Unfragmented Old-Growth Forest in 1954

Unit	0 to 25 Acre Blocks	26 to 100 Acre Blocks	101 to 500 Acre Blocks	501 to 1,000 Acre Blocks	1,000+ Acre Blocks	Total
WAA 405	321	672	2,379	1,327	8,089	12,788
WAA 406	628	1,481	3,964	0	30,821	36,894
Project Area	487	1,099	3,245	1,327	26,412	32,569

Source: GIS Database, Burns, 1997.

Figures for the whole Wildlife Analysis Areas (WAA) 405 and 406 show similar conditions. WAA 405 had approximately 63 percent of the old growth in blocks greater than 1,000 acres in 1954. Approximately 46 percent of these blocks remain in 1997. WAA 406 had 84 percent of the old-growth blocks greater than 1,000 acres in 1954. Approximately 37 percent of these blocks remain in 1997. Both WAAs show a slight increase in the number of small old-growth blocks. Both also show a decrease in the total amount of old-growth acreage since 1954.

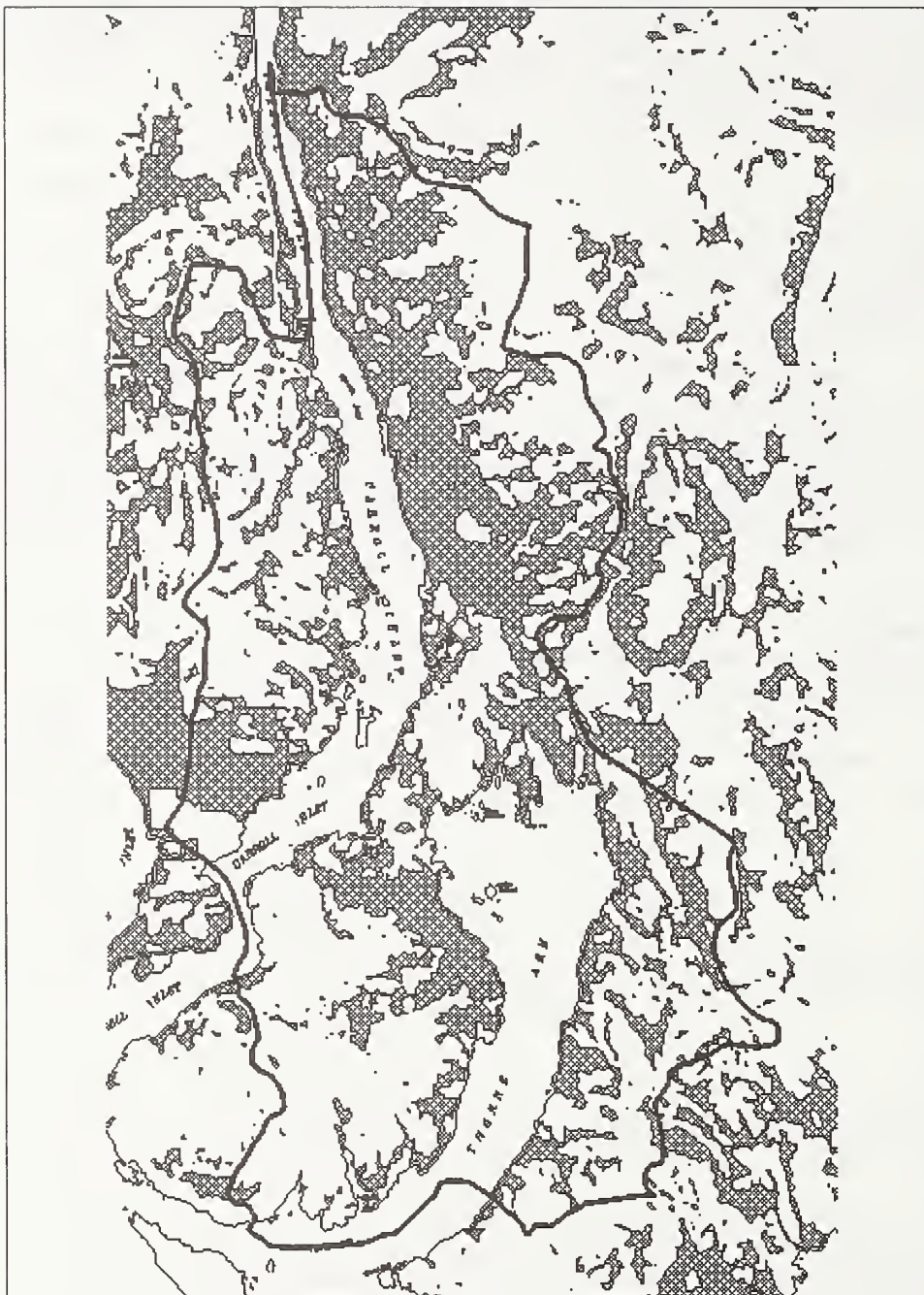
Table Old Growth-3
Acreage of Unfragmented Old-growth Forest in 1997

Unit	0 to 25 Acre Blocks	26 to 100 Acre Blocks	101 to 500 Acre Blocks	501 to 1,000 Acre Blocks	1,000+ Acre Blocks	Total
WAA 405	492	997	2,555	1,560	3,737	9,340
WAA 406	963	2,158	4,779	3,991	11,511	23,402
Project Area	877	1,833	4,732	4,397	5,695	17,534

Source: GIS Database, Burns 1997.

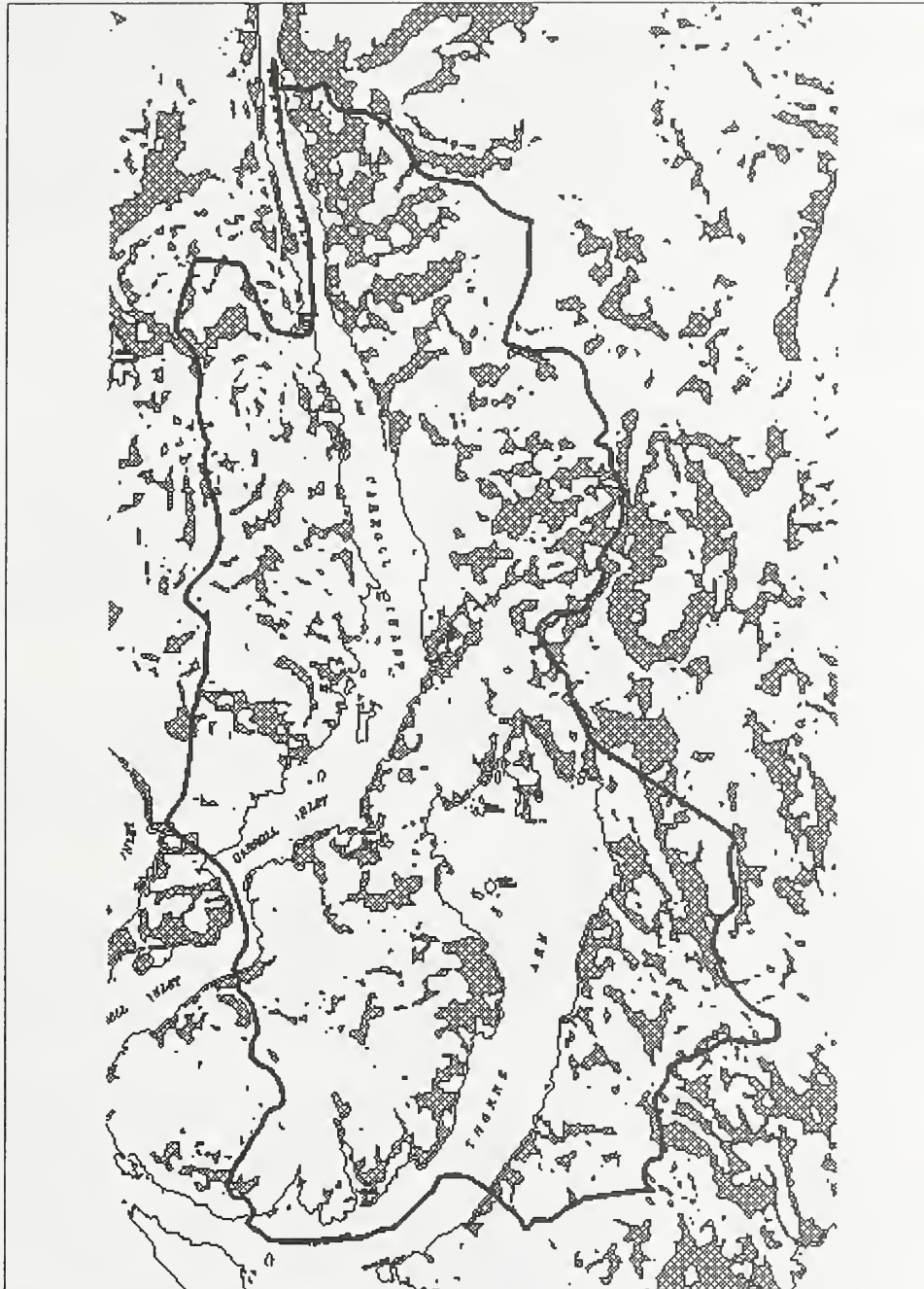
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Figure Old Growth-1
Old-Growth Patches in the Sea Level Project Area in 1954



Source: GIS Database

Figure Old Growth-2
Old-Growth Patches in the Sea Level Project Area in 1997



Source: GIS Database

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Biological diversity and Fragmentation are important considerations in maintaining viable wildlife populations. Fragmentation of existing old growth results in a reduction in the effectiveness of remaining patches as wildlife habitat. Individual species respond to natural and human-induced fragmentation differently. Species like brown creepers and hairy woodpeckers can be supported by smaller patches of forest habitat than species such as deer and marten (proceedings of workshop to recommend patch-size relationships and corridor requirements for the MIS and TES).

Viable Populations

The Forest Plan (1997) identified areas of commercial forest land for the protection of wildlife and fish that are dependent upon old-growth habitat for their survival. These areas are called Old-Growth Prescription areas (Old-Growth Habitat Reserves). In addition to Old-Growth Prescription areas, additional old-growth areas would be designated to benefit wildlife through 2054 (the end of the first 100-year harvest rotation), in lands classified as follows (1989-94 Long-term Sale EIS):

- Inoperable commercial land,
- Lands in extended rotation,
- Lands in Aquatic Habitat Management old-growth prescriptions and
- Lands reserved for recreation purposes.

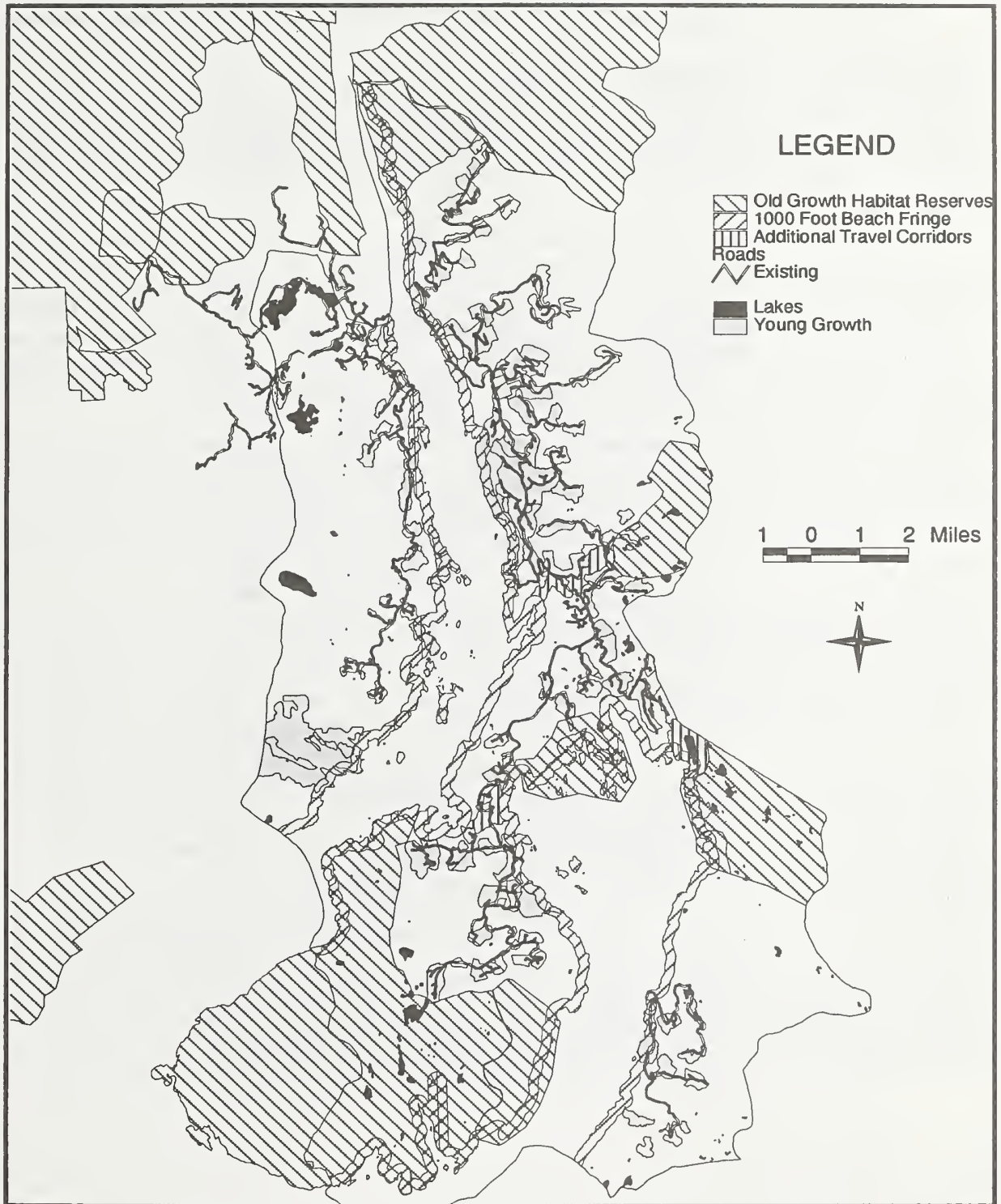
The TLMP Final EIS (1997) provided for regional management and maintenance of population viability at the Ecological Province level. Under the TLMP Final EIS (1997), individual project areas are not expected to independently maintain viable populations, but only to contribute to and not cause a decline of overall viable populations for the province. However, their contribution to well-distributed populations through the maintenance of connectivity can be critical. The Sea Level Project Area lies within the Revillagigedo (Revilla) Island/Cleveland Peninsula Ecological Province (No. 15), as defined by the TLMP Final EIS (1997).

The Revilla Island portion of the ecological province is undeveloped on the east side, and is part of the Misty Fjords National Monument. The Cleveland Peninsula portion of the North Revilla/Cleveland Peninsula Ecological Province is part of the mainland in the Southeast Alaska panhandle. The entire mainland from Hyder/Misty Fjords National Monument north to the Juneau / Skagway area is in a natural (unaltered by human activities) state, except for some small isolated developments.

The Sea Level Project incorporates the viable population strategy from the TLMP (1997). The TLMP Final EIS (1997) maintains wildlife populations through a complex of large, medium, and small old-growth habitat reserves laid out across the Tongass National Forest totaling one million acres, outside congressionally designated areas. These reserves are identified as old-growth habitat prescriptions in the TLMP. This strategy implements the concepts recommended by the Viable Population (VPOP) Committee.

Figure Old Growth-3 shows the location of small, medium, and large old-growth habitat reserves (prescriptions) within the Sea Level Project Area as designated in the TLMP (1997). Large and medium old-growth reserves surrounding the Sea Level Project include the Naha Block to the north, the Swan Lake block to the north, Misty Fjords National Monument to the east, and one block south of Gnat Cove on the peninsula between Carroll Inlet and Thorne Arm (Carroll Point Reserve). Five small old-growth reserves have been located in the Project Area. They are located north of Licking Creek on the east side of Carroll Inlet (Licking Creek), at the head of Painted Creek near Shoal Cove (Painted Creek), at the head of Thorne Arm (Mop), in the Gokachin Creek area (Gokachin), and on the west side of Thorne Arm (West Thorne).

Figure Old Growth-3
Existing Old-Growth Prescription Blocks and Connecting Corridors



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All Old Growth Reserves meet the requirements of TLMP (1997) except for the Mop small Old Growth Reserve. This Old Growth Reserve as identified in TLMP (1997) is about 150 acres less than the required total acreage. However, it does contain the required amount of productive old growth.

Connecting Corridors

Connecting corridors are an important part of any strategy to maintain biodiversity and viable populations. It is recognized that maintaining appropriate habitat corridors or connections between blocks of old-growth forest habitat is important to minimize isolation and gradual decline of wildlife species associated with the old-growth blocks (Harris 1984, 1985; Hunter 1990).

Prior to timber harvest activities, the main dispersal corridors throughout the Project Area were most likely along major creeks and near the beach. Major creek valleys, such as Fish Creek, Gokachin and Sea Level Creeks, Painted Creek, Marble Creek, and Calamity Creek, probably served as migration or dispersal corridors between Carroll Inlet and what is now Misty Fjords National Monument. On the west side of Carroll Inlet, Buckhorn Creek, Gunsight Creek, and the North and South Saddle Lakes areas probably served the same function between George and Carroll Inlets. These valleys contained extensive amounts of old growth which were mostly connected (Figure Old Growth-2).

The forest in some of these connecting valleys has been harvested and no longer provides interior old-growth connections (Figure Old Growth-3). Marble and Calamity Creeks (east side of Carroll Inlet) are two examples. Some of the beach fringe was also harvested during the A-frame era, causing breaks in the connectivity. There is a large patch of young growth north of Shoal Cove that interrupts the old-growth beach connection. The beach fringe south of Shelter Cove (west side of Carroll Inlet) has also received past harvest that has reduced old-growth connectivity.

The TLMP (1997) directs us to provide corridors of old-growth forest among large and medium old-growth habitat reserves and other natural setting LUDs at the landscape scale. These corridors are part of the overall viable population strategy on the Tongass National Forest. The TLMP considers the existing features of the old-growth strategy, such as beach fringe, riparian buffers, or other lands unsuitable for development, as contributing to maintaining connectivity among large and medium old-growth habitat reserves and natural setting LUDs. Where these features do not provide sufficient productive old-growth forest connectivity, the TLMP directs us to provide stands, where they exist, of productive old-growth forest to function as connecting corridors. These designed corridors should be of sufficient width to minimize edge effect and provide interior forest conditions.

These guidelines have been implemented for the Sea Level Project Area. Figure Old Growth-3 shows the locations of the old-growth habitat reserves (prescriptions) and connecting corridors within the Sea Level Project Area as designated in the TLMP (1997). All medium and small old-growth habitat reserves are sufficiently connected to other large or medium old-growth habitat reserves or natural setting LUDs except for one. The medium old-growth habitat reserve between Thorne Arm and Carroll Inlet requires additional connecting corridors. This is mainly due to the amount of previous harvest that has occurred in the Shoal Cove area and in the beach fringe north of Shoal Cove. Therefore, additional connecting corridors were designed for Alternatives 1, 2, and 5 as shown in Figure Old Growth-3.

Effects of the Alternatives

Analysis conducted for the TLMP Final EIS (1997) indicates that 66 to 94 percent of the productive old-growth forest would remain distributed throughout the planning cycle (150 years) within the Revilla Island/Cleveland Ecological Province to potentially support viable populations of management indicator species (MIS). All alternatives proposed by this EIS provide areas that would remain connected by existing roadless areas, beach fringe, estuary fringe, stream corridors, and the myriad of over-steepened slopes and other areas unsuitable for timber harvest. Managed stands would change from multi-aged old-growth timber to even-aged stands of timber in the early succession/understory colonization stage.

Effects of Alternatives on Old-Growth Forest and Biodiversity

There has been a national concern over the limited and dwindling supply of old-growth forest, as exemplified by the spotted owl controversy in Oregon and Washington. Approximately six percent of the old-growth forest in the Revilla Island/Cleveland Peninsula has been harvested. Under the TLMP Final EIS (1997) Preferred Alternative, approximately 16 percent of the old-growth forest in the Revilla Island/Cleveland Ecological Province will eventually be converted from old-growth forest to successive crops of younger trees which will be harvested before they mature into old-growth forest. The subsequent crops of younger trees will yield more usable wood fiber per acre. At the same time, this conversion of old-growth forest to younger stands will cause some changes in the value of certain forest products, changes in value of wildlife habitat, reductions in diversity of ecosystem function and composition, and changes in inherent aesthetic qualities. Figure Old Growth-2 displays the amount of old-growth habitat within the Project Area that existed in 1954.

Old-Growth Fragmentation

The TLMP (1997) addressed the issue of forest fragmentation on a Forest-wide landscape scale through the identification of non-development LUDs and the Old-Growth Habitat Reserve strategy. It is recognized that areas between these non-development LUDs will be fragmented as the Forest Plan is implemented. The identified corridors provide a link through these fragmented areas to connect the non-development LUDs. The Sea Level Project minimizes fragmentation on a landscape scale through implementation of the Forest Plan (TLMP 1997).

The Draft EIS fragmentation analysis showed significant fragmentation in the Project Area between the non-development LUDs. Fragmentation for the alternatives in the Final EIS are similar to those of the Draft. In the Final EIS, fragmentation for Alternative 2 will be the same as that shown in the Draft EIS Analysis. Alternative 5 will also be the same as that shown for Alternative 5 in the Draft EIS analysis. Alternative 7 is a combination of the Draft EIS Alternatives 3 and 4. Fragmentation for Alternative 7 will be somewhere between that shown in the Draft EIS Alternatives 2 and 3 analysis.

To look at potential cumulative effects, we projected the potential effects of harvesting all operable land through one complete rotation. The result is shown in Table Old Growth-4. This map is provided as a best estimate of future conditions. This information is based on TLMP Final EIS (1997) cumulative effects analysis. The TLMP (1997) cumulative effects analysis is incorporated here by reference.

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Figure Old Growth-4
Old-Growth Patches in the Sea level Project Area in 2095



Conservation Biology Strategy

Effects of the Alternatives on Viable Populations of Wildlife

The Tongass National Forest now has a Viable Population Strategy as identified in the Forest Plan (TLMP 1997). The Sea Level Project maintains the options for implementation of such a population viability strategy by maintaining large, medium, and small old-growth habitat reserves and other nondevelopment areas such as Misty Fiords and Naha LUD II areas. Since all alternatives will not be affecting the large and medium old-growth habitat reserves identified in the TLMP Final EIS (1997), the size and spacing requirements identified in that strategy will be met.

The Carroll Point medium Old-growth Reserve contains a large portion of encumbered lands. About 78 percent of the old-growth reserve is in encumbered lands (14,300 acres). Approximately 4,020 of productive old-growth forest are in encumbered lands. These lands are not currently being considered for conveyance to private property. Very little interest has been shown in selecting the area. However, if the area gets selected, conveyed, and becomes private property in the future, it could be altered so that it no longer functions as an old-growth habitat reserve area.

The Carroll Point old-growth reserve would then be about 4,100 acres. The productive old-growth within the reserve would be about 1,180 acres, about 4,020 acres less than the current situation. The remaining portion of the old-growth reserve would not meet the intended requirements for size and spacing of medium old-growth reserves. This would leave a gap in the TLMP (1997) viable population strategy. If this were to happen, the Carroll Point Old-Growth Reserve would need about 4,020 acres of productive old growth to return to current conditions. These productive old-growth acres would have to come from the Minx Flats area near Gnat Cove. The old-growth reserve would need to be enlarged almost to Shoal Cove to pick up the needed productive old growth. Harvesting units in the Minx Flats area (Units 31, 32, 33, 37, 171, 172, 173, 174, 175, 176, 153, 168, 166, 168 and 250) will make it difficult to meet the medium old-growth reserve requirement if the encumbered lands are selected and harvested. These units are proposed in Alternative 2. Alternative 7 includes Units 29, 33, 36, 32, 37, 168, and 250. If these units are harvested now and the encumbered lands are selected in the future, there could be a gap in the viable population strategy in the future.

Small old-growth habitat reserves have been identified under the TLMP as well (Figure Old Growth-3). Our analysis shows that all VCUs meet the size, spacing, and productive old-growth requirements for small old-growth reserves, except the Mop old-growth reserve. The Mop old-growth reserve is about 150 acres less than the total acreage required in TLMP. However, the productive old-growth acreage within the reserve is about 140 acres more than the TLMP requirement. Enlarging the Mop reserve would not necessarily result in more habitat for old-growth dependant species.

TLMP (1997) indicated that project analysis would include an analysis of the small old-growth reserves and whether they met the intended size and spacing requirements in TLMP. The Tongass Land Management Plan (1997) Record of Decision says "The Forest Service also will work with other Federal and State agencies on interagency reviews of the location of small old-growth habitat LUD reserves in relation to where new projects are being planned".

An interagency group of biologists conducted a field review of the small old-growth reserves on June 7 - 10, 1998. The group came to consensus on the locations of the small old-growth reserves affected by the Sea Level Project. This is discussed below by VCU.

VCU 7460:

The group recommended leaving the small Old-Growth Habitat Reserve in this VCU as it is identified in TLMP (1997). It is north of the Shoal Cove road system. Much of the remaining parts of this VCU contain many roads and previously harvested units.

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VCU 7530:

The group recommended leaving the small Old-Growth Habitat Reserve in this VCU as it is identified in TLMP (1997). The south side of the reserve includes part of low elevation valley that connects to Misty Fjords National Monument via a low pass. The usefulness of this reserve depends on maintaining the connecting corridor along Painted Creek to the beach fringe along Carroll Inlet. Alternative 7 will not harvest Units 5 and 60 in the Sea Level Project to protect the corridor along Painted Creek connecting the reserve with the beach. Alternative 7 will not harvest Unit 59 in the Sea Level Project to maintain habitat integrity at the pass where the old-growth reserve meets up with Misty Fjords National Monument.

VCU 7570:

The group recommended leaving the small Old-Growth Habitat Reserve in this VCU as it is identified in the TLMP (1997).

VCU 7552:

The group recommended leaving the small Old-Growth Habitat Reserve in this VCU as it is identified in the TLMP (1997). The group discussed moving the reserve south along Sea Level Creek, but elected against it because it would encourage road building through the reserve to access timber to the north. Leaving the reserve where it is would keep road construction and timber harvest south of the reserve.

VCU 7560:

The group recommended moving the small Old-Growth Habitat Reserve from its current location near Mop Point/Minx Islands to south of Gnat Cove as shown in Figure Old-growth-5. This is a change from the Draft EIS. This small reserve has been moved in Alternative 7 for the following reasons:

- Protection of quality habitat. The habitat appears to be higher quality and in a larger contiguous block.
- Minimized Fragmentation. The recommended reserve would help minimize further fragmentation on the Carroll Point peninsula.
- Reduced wildlife viability risks on the Carroll Point Peninsula. It improves connectivity between the medium old-growth reserve to the south and Misty Fjords National Monument, and improves the connective corridor between Carroll Inlet and Thorne Arm. Also, it appears to be the best general wildlife habitat in the Gnat Cove area, including the medium old-growth reserve.
- To preserve future options in case the overselected lands in the medium old-growth reserve are ever selected and harvested.

The new small Old-Growth Habitat Reserve in Alternative 7 has a total acreage of 1395 acres. Productive Old Growth (POG) within the reserve is 716 acres. There are roads and a fair amount of young growth timber in the reserve. They were included to reach the required total acres.

The new reserve boundary follows natural topographic features as much as possible. The boundary follows the beach on the east, then follows a creek west to the VCU boundary, follows the VCU boundary south along the ridge top, then follows another creek east down to the beach. This was done to allow for easy identification on the ground so the reserve could be accurately implemented.

According to the Interagency group that reviewed the small Old-Growth Reserves, the usefulness of the VCU 7560 small Old-Growth Habitat Reserve is dependant on maintaining connectivity to the Carroll Point medium reserve via the corridor shown in Figure Old Growth-5. This corridor is recommended because of previously harvested beach fringe along Thorne Arm, which disrupts the beach fringe connection. In Alternative 7, the connecting corridor has been moved from east of Gnat Cove to south of Gnat Cove. The new corridor includes better habitat and connects the new small Old-Growth Habitat Reserve (Alternative 7) in VCU 7560 to the beach fringe and to the Carroll Point medium Old-Growth Habitat Reserve.

Table Old Growth-4
Old-Growth Habitat Reserve (OGHR) Acres and Productive Old-Growth (POG) Acres in the Old-Growth Habitat Reserves, By VCU

VCU	VCU Acres	Alternatives 1, 2, and 5		Alternative 7	
		OGHR Acres	OGHR and POG Acres	OGHR Acres	OGHR and POG Acres
7552	8,156	3,859	2,039	3,859	2,039
7460	2,6297	5,658	3,289	5,658	3,289
7560	8,224	1,160	800	1,395	716
7530	2,9667	5,736	2,538	5,736	2,538
7570	1,1135	1,919	1,060	1,919	1,060

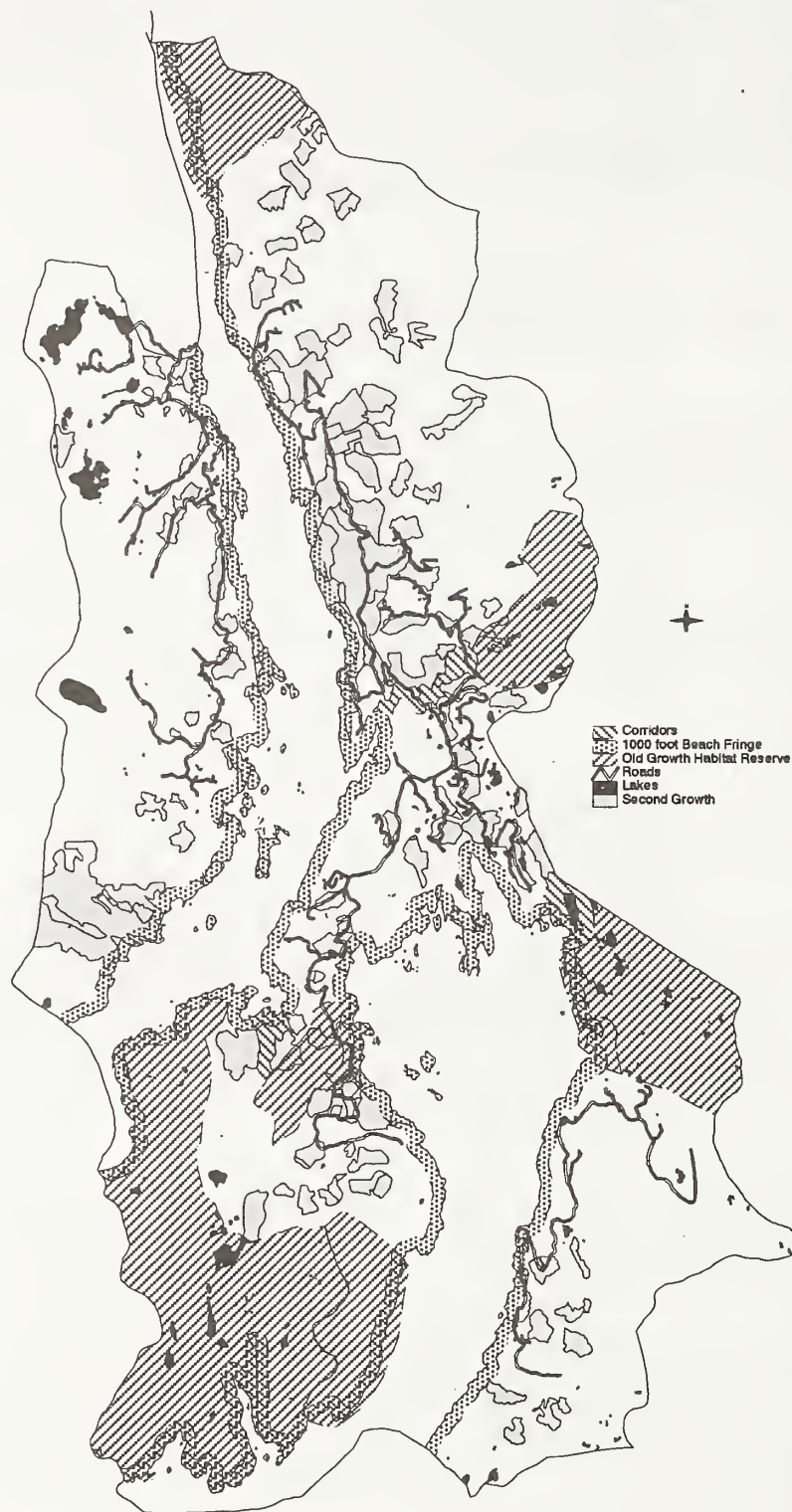
Source: Burns 1999, from GIS database

Moving the small Old-Growth Habitat Reserve in VCU 7560 from its current location to the location proposed in Alternative 7 would reduce the Suitable Timber Base by approximately 315 acres and 9,835 MBF. The existing Suitable Timber Base in the Sea Level Project Area would be reduced from 17,096 acres and 516,194 MBF to 16,781 acres and 506,359 MBF. For more information about these changes by Volume Strata, see the Silviculture and Timber Section in this Chapter.

All small Old-Growth Habitat Reserves are consistent with the TLMP (1997) direction and the TLMP (1997) Viable Population Strategy.

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Figure Old Growth-5
Old-Growth Habitat Reserves for Alternative 7



Effects on Connecting Corridors.

Figure Old Growth-3 shows the important travel corridors in the Sea Level Project Area as identified in the TLMP (1997). The beach fringe provides a good corridor in most cases. However, the beach fringe north of Shoal Cove has received extensive past harvest, making it less suitable as a connecting corridor. Therefore, additional connecting corridors have been identified for this project (Figure Old Growth-3).

Alternatives 1, 5, and 7 maintain all corridors in the existing condition. Alternative 2 harvests one unit in the Painted Creek Corridor (Unit 60). This unit reduces the width of the corridor to about 100 feet in places. The corridor is already less than 1,000 feet (the preferred width for maintaining interior old-growth conditions) in many places due to second growth from past harvest activities. This would greatly reduce the effectiveness of this connecting corridor. Alternatives 2 also harvests a small unit in the corridor between Carroll Inlet and Thorne Arm. This unit is small and results in minimal impacts to that corridor.

Alternative 1 maintains connectivity better than other alternatives. Of the action alternatives, Alternative 5 was developed to address connectivity concerns between the Carroll Point medium Old-Growth Habitat Reserve and other reserves and non-development LUDs. This alternative avoids harvesting in the Minx Flats area to facilitate connectivity between the Carroll Point Old-growth Habitat Reserve and Misty Fjords National Monument.

In Alternative 7, the connecting corridor has been moved from east of Gnat Cove to south of Gnat Cove (Figure Old Growth-5). The new corridor includes better habitat and connects the new small Old-Growth Habitat Reserve in VCU 7560 to the beach fringe and to the Carroll Point medium Old-Growth Habitat Reserve.

None of the alternatives propose harvest units in the Fish Creek corridor. All alternatives maintain the beach fringe as connecting corridors.

Comparison of Alternatives

Based on old-growth habitat and fragmentation analysis, Alternative 1 would do the most to preserve the natural biological diversity of the Project Area and maintain natural ecosystem processes. Of the action alternatives, Alternative 5 maintains the most acreage in large old-growth patches and Alternative 2 maintains the least.

The Sea Level Project is consistent with the TLMP (1997) Viable Population Strategy. All small Old-Growth Habitat Reserves are consistent with TLMP (1997) direction and the TLMP (1997) Viable Population Strategy. The TLMP strategy of maintaining large, medium, and small Old-growth Habitat Reserves and connecting corridors that exist within the Project Area and adjacent areas will maintain well-distributed, viable populations of old-growth associated wildlife species.

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Recreation

Key Terms

Developed recreation—occurs where more facilities and amenities are incorporated into a site to accommodate intensive recreation activities in a defined area.

Dispersed recreation—requires few improvements or specific developed sites and may occur over a wide area; for example, activities related to roads, trails, and undeveloped waterways and beaches.

Recreation Opportunity Spectrum (ROS)—a system for planning and managing recreation settings. There are seven classes which are defined by how they satisfy certain recreation experience needs:

Primitive (P)—an unmodified environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is essentially free from evidence of human-induced restrictions and controls. Motorized use is not present except for infrequent boats and planes.

Semi-Primitive Non-Motorized (SPNM)—a natural or natural-appearing environment of moderate to large size. Concentrations of users are low, but there is often evidence of other users. No roads are present in the area.

Semi-Primitive Motorized (SPM)—a natural or natural-appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. Local roads used for other resource management activities may be present. Along saltwater shorelines there may be extensive motorized boat traffic.

Roaded Natural (RN)—a natural-appearing environment with moderate evidence of the sights and sounds of humans. Such evidence usually harmonizes with the natural environment. Interaction between users may be moderate to high with evidence of other users prevalent. Motorized use is allowed.

Roaded Modified (RM)—a natural environment that has been substantially modified, particularly by vegetative manipulation. There is strong evidence of roads and/or highways. Frequency of contact is low to moderate.

Recreation place—an identified geographic area having one or more physical characteristics that are particularly attractive to people engaging in recreation activities; can contain from zero to several recreation sites.

Recreation site—a specific location where recreational activities occur and/or a recreational facility is located; there can be several sites within a recreation place.

Roadless area—An area of undeveloped public land within which there are no improved roads maintained for travel by means of motorized vehicles intended for highway use (TLMP).

Affected Environment

Current Use

Most of the recreation and tourism use in the Project Area takes place in the saltwater bays and coves within and adjacent to the Project Area. The Area receives relatively significant local use for recreation activities. Near the Project Area, saltwater areas are used by several

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sport-fishing charter boats and outfitter guides. Portions of the Project Area provide settings for recreational activities and are inventoried as recreation places.

Recreation activities in or near the Project Area include fresh and saltwater sport fishing, hunting, camping, hiking, beachcombing, wildlife and scenic viewing, and boating (kayak, canoe, or motorboat). Flightseeing trips from nearby Ketchikan to Misty Fiords National Monument Wilderness (MFMNW), recreation cabins, and the Swan Lake power plant are common. Within the Project Area there is one Forest Service recreation cabin. It is located on the north shore of Thorne Arm at the mouth of Fish Creek. The Low Lake Trail follows Fish Creek to Low Lake. The Gokachin Lake Trail follows Granite Creek to Starr Lake. Both trails provide access to the boundary of MFMNW. Outside the Project Area, in MFMNW, two Forest Service cabins can be found on the shoreline of Ella Lake and one privately owned cabin is located on the east shore of Mirror Lake.

As there is no road connection from the Project Area to Ketchikan, access is achieved by personal or commercial boat and aircraft. Past timber harvest and small networks of associated road are frequent on the Project Area. Recreationists who reach these areas (15 to 30 miles from Ketchikan) enjoy viewing wildlife, scenery, and hunting big game and waterfowl. Both freshwater and saltwater fishing are popular in the immediate vicinity.

Information about public demand for various recreation opportunities within the Project Area came from four sources:

- the Alaska Public Survey of 1979,
- an Alaska Department of Fish and Game (ADF&G) survey in 1989,
- businesses and groups that discuss nonconsumptive uses of wildlife (i.e. wildlife viewing, photography), and
- the Ketchikan Community Survey of 1990.

The natural setting and remoteness associated with marine and freshwater recreation places were rated as "very important" by 80 to 90 percent of the recreation users of the Tongass National Forest. When users were asked about their sensitivity to change, natural-appearing settings and solitude were the most important attributes indicated that they did not want to see modified. A sizeable number of Alaska residents indicated that they would stop going to their favorite places if development-related activities occurred on the site (Alaska Public Survey 1979).

The ADF&G survey related to wildlife viewing also indicated that people engaged in wildlife viewing were concerned that various development activities such as logging, remote homesites, and small aircraft use could adversely effect the quality of their wildlife viewing experience.

Southeast Alaska residents place a high value on opportunities for remote, uncrowded outdoor recreation. At the same time, community access is important to those wanting to do more hunting, fishing, and beachcombing. In particular, Ketchikan residents want to see an expansion of the usable road system on Revillagigedo (Revilla) Island primarily for the purpose of roaded recreation opportunities (Ketchikan Community Survey 1990). Development of new hiking trails and bicycle paths are the most desired opportunities.

The process used to classify recreation opportunities on National Forest System lands is the Recreation Opportunity Spectrum (ROS). The ROS process is a method used to inventory an area's potential recreational opportunities. This system can be used to evaluate the changes that can occur in a given area as a result of different land-use management activities.

The ROS system portrays a range of recreation activities, settings, and experiences from primitive to urban. Criteria defining the various ROS settings are based on a variety of

Recreation Demand

Recreation Opportunity Spectrum

factors including: remoteness, landscape character, facilities present, amount of human modification to the natural landscape, and the opportunity for solitude. Of the six ROS classes, four are present within the Project Area (see Figure Recreation-1, Existing ROS Inventory Map). A summary of the existing acreages by ROS class and the percent of the Project Area is displayed in Table Recreation-1.

**Table Recreation-1
Existing ROS Classes**

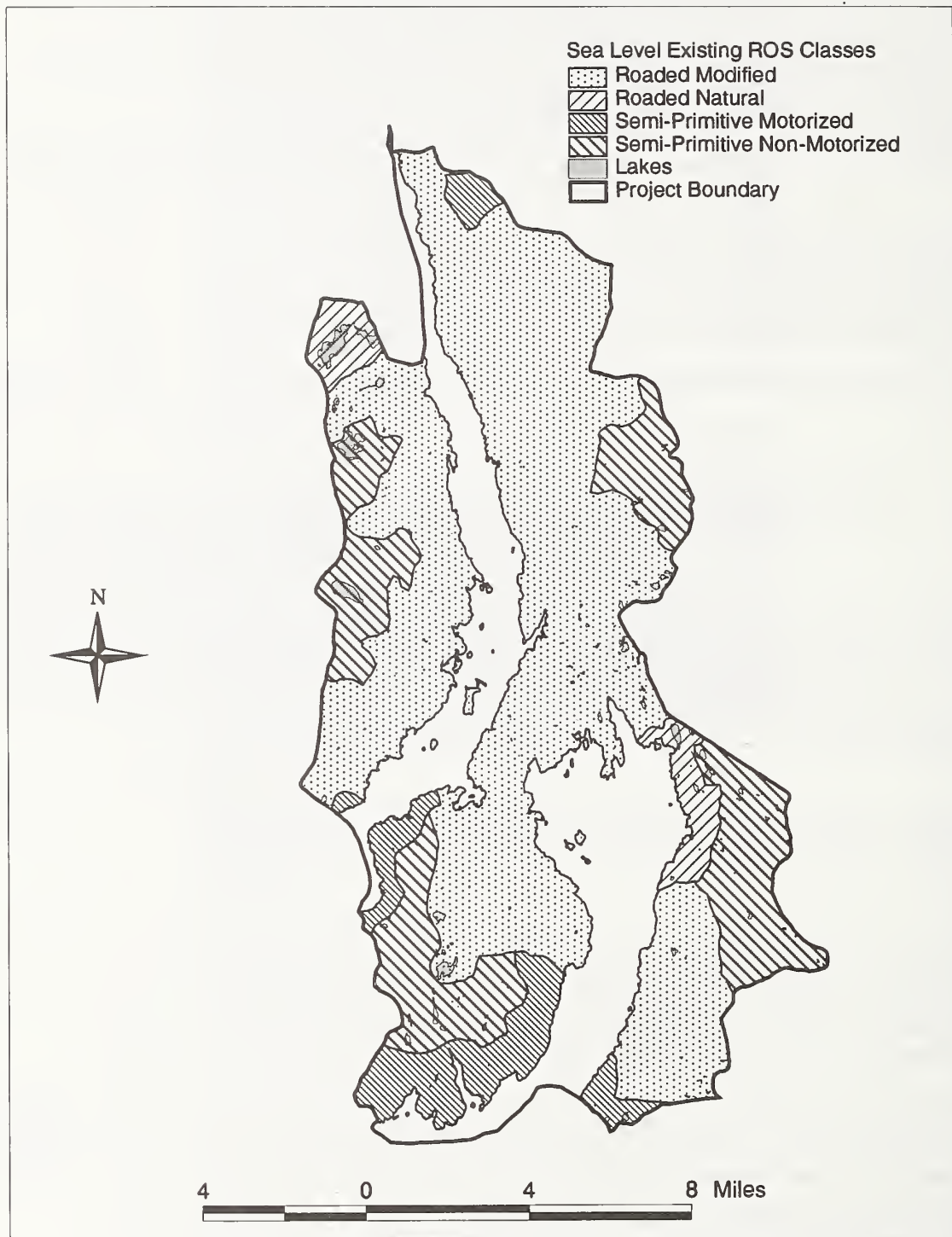
ROS Class	Acres	Percent of Project Area
SPNM	20,964	22.15
SPM	8,407	8.87
RN	4,056	4.29
RM	61,231	64.69
Project Area Total	94,658	100.00

Source: GIS, Benson 1998.

Approximately 94,658 acres of the Project Area are included within four ROS settings: Semi-Primitive Non-Motorized (SPNM), Semi-Primitive Motorized (SPM), Roaded Modified (RM) and Roaded Natural (RN). Roaded Modified occurs where roaded timber harvest has occurred in the past such as along low-lying shorelines (Shelter Cove) and stream valleys (Saddle Lakes, Licking and Granite Creeks). A network of roads access these areas but are not linked to any road system from Ketchikan nor are they linked to each other. Most of the Semi-Primitive Non-Motorized and Motorized ROS classes are located on the southern shorelines and inland creek valleys on both sides of Thorne Arm and of a small portion inside Carroll Inlet.

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Figure Recreation-1
Existing ROS Class Inventory Map



Recreation Places

A recreation place is identified as a geographic area having one or more physical characteristics attractive to people engaging in recreation activities; can contain from zero to several recreation sites. These places may be beaches, waterfalls, streams, lakes, scenic features, bays, anchorages, existing and potential recreation sites, and trails. Each recreation place has some activity associated with it such as hiking, camping, hunting, or viewing scenery or wildlife. These recreation places define the inventoried recreation areas which are important for existing and potential recreation uses. See the Scenic Resources section in this chapter for further discussion on the scenic features or attributes of the Project Area.

There are 17 recreation places identified within the Project Area, 13 existing and 4 potential. Table Recreation-2 displays the recreation places including the number of acres, the ROS class, the existing and potential recreation activities, and the current Tongass Land Management Plan (TLMP 1997) Land-Use Designations. Figure Recreation-2 shows the location of each recreation place and whether it is existing or potential.

Table Recreation-2
Recreation Places Within the Sea Level Project Area

Recreation Place	Acres	ROS*	Recreation Activities	Recreation Sites**	TLMP LUDs***
Carroll Inlet					
1. Black Mountain	394	SPNM	hiking, hunting	hiking trail (E)	SM
2. Gnat Cove	745	RM	beachcombing, boating, saltwater fishing	anchorage (E)	ML
3. Marble Creek	209	RM	dispersed camping, hunting	anchorage (E)	ML
4. Osten Island Area	707	RM	beachcombing, boating, saltwater fishing	anchorage (P)	SM/ML
5. Shelter Cove	31	RM	boating, saltwater fishing, hiking,	boat dock (P) boat launch (P) anchorage (E)	ML
6. Shoal Cove	265	RM	boating, hiking, hunting	boat dock (E)	ML
Thorne Arm					
7. Coho Cove	1,614	SPM	boating, hunting, saltwater fishing	anchorage (P)	SM
8. Fish Creek	470	RN	cabin use, hiking, boating, stream fishing, hunting, canoe/kayaking, saltwater fishing, scenic & wildlife viewing	cabin (E) anchorage (E) hiking trail (E)	SM
9. Granite Creek	370	RN	boating, hiking, hunting	hiking trail (E)	ML
10. Granite Lake	1,323	SPNM	hiking, hunting	hiking trail (E)	ML
11. Moth Bay	1,576	SPM	boating, hunting, saltwater fishing	anchorage (E)	SM
12. Sea Level Mine	1,425	RM	boating, hunting, fishing	anchorage (E)	ML

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Table Recreation-2 (cont.)
Recreation Places Within the Sea Level Project Area

Recreation Place	Acres	ROS*	Recreation Activities	Recreation Sites**	TLMP LUDs***
Common To Project Area					
13. Shoreline and Estuary	17,476	RM	boating, saltwater fishing, scenic & wildlife viewing	boat dock anchorage (P) (P)	ML
Potential					
14. Elf Point ¹	272	RM	boating, hiking, hunting, saltwater fishing	boat dock (P)	TP
15. North Saddle Lakes ²	1,796	RN	canoe/kayaking, developed camping, lake fishing, picnicking	campground picnic site (P) (P)	SV
16. Puzzle Lake ³	1,569	SPNM	developed camping, lake fishing	campground picnic site (P) (P)	TP
17. Snipe Point ⁴	214	RM	boating, hiking, hunting, saltwater fishing	boat dock (P)	ML
Adjacent to Project Area					
18. Swan Lake ⁵	N/A	RM	lake fishing boating, picnicking	anchorage boat dock (E) (P)	Private
19. MFNMW ⁶	N/A	SPNM and SPM	cabin use, camping, fishing	cabin hiking trails (E) (E)	W

Source:

1 Elf Point: located in the southwestern portion of the Project Area on the western shore of Thorne Arm. This is the existing Elf Point LTF site.

2 North Saddle Lakes: located in the northeastern corner of the Project Area between Shelter Cove on Carroll Inlet and Upper George Inlet.

3 Puzzle Lake: located in the northeastern corner of the Project Area, south of the North Saddle Lakes and east of Shelter Cove.

4 Snipe Point: located in the southern portion of the Project Area on the east shore of Thorne Arm. This is the existing Snipe Point LTF site.

5 Swan Lake: located on Carroll Inlet's east shore just north of the Project Area and is the site of the local power generation source for Ketchikan.

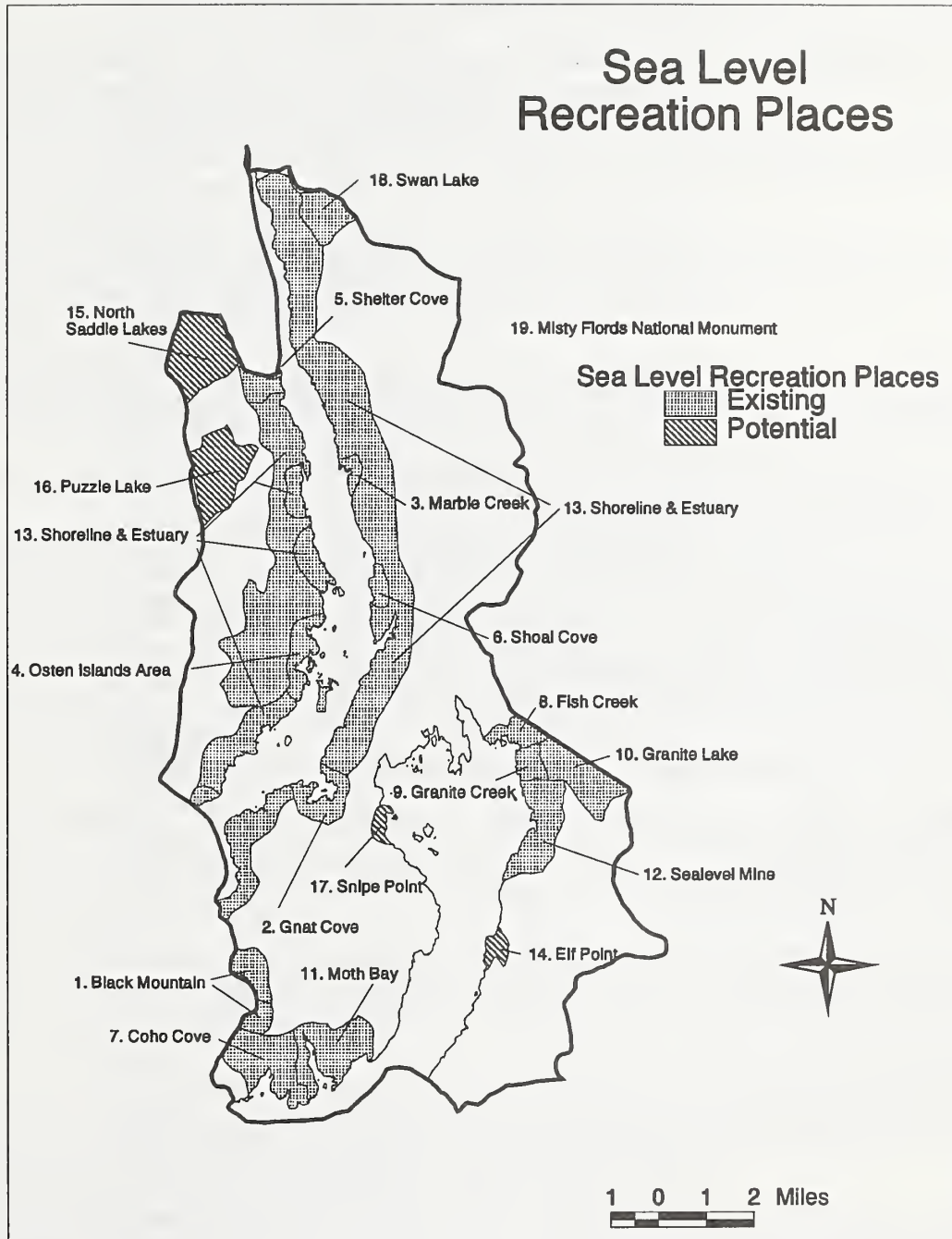
6 MFNMW: located immediately adjacent to the Project Area on its eastern boundary. Access from the Project Area is limited due to extremely rugged alpine ridges forming a boundary between the two areas.

* SPNM = Semi-Primitive Non-Motorized, SPM = Semi-Primitive Motorized, RN = Roaded Natural, RM = Roaded Modified

** (E) = Existing Recreation Site, (P) = Potential Recreation Site, (N/A) = Not Available

*** ML = Modified Landscape, SM = Semi-remote Recreation, SV = Scenic Viewshed, TP = Timber Production, W = Wilderness

Figure Recreation-2
Recreation Places—Existing and Potential



Direct and Indirect Effects of the Alternatives

Use and Demand

Future recreation use and demand in the Project Area is expected to change with implementation of any of the alternatives. Existing recreation activities and patterns are associated with a combination of natural and roaded settings. The action alternatives generally would add to existing road networks and increase recreation access.

As recreation settings change, recreationists will have several options. Some will find the conversion of areas to roaded settings unacceptable and will either cease their activity or be displaced to other areas such as the Naha River, Cleveland Peninsula or MFNMW. Some recreationists will adapt to the changes in the settings and continue to pursue traditional activities in the Project Area. Other recreationists will be attracted to opportunities within the roaded settings. Consequently, the use patterns are expected to change slightly.

Impacts of Alternatives on ROS

The proposed harvest in the action alternatives occurs in areas classified as RM (due to harvest within the past 30 years) or in SPNM areas immediately adjacent to RM areas. With the action alternatives, these SPNM areas will change to RM.

Misty Fiords National Monument Wilderness will not be physically impacted by any of the proposed alternatives of this EIS.

Table Recreation-3 displays the acres in each ROS class, by alternative, for the Project Area and the percent the acreage changed from the current condition.

Table Recreation-3
ROS Class Distribution by Alternative and Percent Change

Alternative	Roaded Modified		Roaded Natural		Semi-Primitive Motorized		Semi-Primitive Non-Motorized	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
1	61,232		4,057		8,407		20,964	
2	70,653	15.4	2,657	-34.5	8,407	0	12,942	-38.3
5	63,389	3.5	4,057	0.0	8,407	0	18,807	-10.3
7	68,123	11.3	3,370	-16.9	8,407	0	14,760	-29.6

Source: GIS, Benson 1998.

In the action alternatives, Roaded Natural acres would decrease the most (34.5 percent) in Alternative 2 and the least in Alternative 5 (no reduction). Roaded Modified acres would increase the most (15.4 percent) in Alternative 2, the least in Alternative 5. Semi-Primitive Motorized acres would not be affected by any of the alternatives. Semi-Primitive Non-Motorized acres would decrease the most (38.3 percent) in Alternative 2, the least in Alternative 5.

Alternatives

All of the action alternatives would result in changes in the amount of nonroaded and roaded ROS settings found in the Project Area. Under Alternatives 2, 5 and 7, there would be an increase in roaded ROS settings. As a result, there would be more accessible recreational activities such as camping, freshwater angling, wildlife viewing, and hunting. Conversely, there would be a reduction in areas with attributes associated with nonroaded or primitive settings. The effects of each alternative on the ROS settings are discussed below.

The primary change from the existing condition, as a result of implementing action on all alternatives would be a reduction in the Semi-Primitive ROS settings and an increase in the Roaded Modified settings. The areas impacted by the alternatives have been identified under in the Plan as commodity-producing lands with a Roaded Natural desired future setting.

Alternative 1

Alternative 1, the existing condition or no-action alternative, is the baseline for comparing the effects of the action alternatives on recreation. The existing condition is described in the preceding Affected Environment section.

Alternative 2

Alternative 2 proposes harvesting 105 units and constructing 51 miles of new road. This alternative would reduce the SPNM acres by 38.3 percent and the RN acres by 34.5 percent. The reduction of SPNM and RN means an increase of the RM acres by 15.4 percent. The areas most impacted by this alternative would be the SPNM and RN areas around North Saddle, Puzzle and Buckhorn Lakes in the northwest portion of the Project Area, and along Sea Level Creek in the southeastern portion of the Project Area bordering MFNMW.

Under this alternative there would be helicopter logging near the MFNMW boundary in the southeastern portion of the Project Area (Elf Point). Units 128, 139 and 140 are closest to the Monument boundary and have the potential for the greatest impacts due to helicopter noise. Currently this area receives very little use and impacts are minimal. This alternative also proposes four units with new road construction along the Monument boundary (units 45, 46, 56 and 59) east of Shoal Cove. There are concerns that logging activity in these areas will increase access into Third Lake and Big Lake within MFNMW and that noise from the logging and road building activities may be heard along the Low Lake Trail and Big Lake.

Alternative 5

Alternative 5 proposes harvest in the existing RM areas and would reduce the amount of SPNM acres in the Puzzle and Buckhorn Lakes area by 10.3 percent. Alternative 5 proposes 30 units on both the Shoal Cove and Shelter Coves sides of Carroll Inlet with 17.0 miles of new road.

This alternative proposes Unit 56 that borders the boundary of MFNMW. As stated under the analysis of Alternative 2, there are some concerns that harvest of units along the boundary may impact people recreating along the Low Lake Trail and Big Lake within the MFNMW.

Alternative 7

Alternative 7 proposes harvesting 68 units and constructing 30.0 miles of new road. This alternative would reduce the SPNM acres by 29.6 percent and the RN acres by 16.9 percent. These reductions mean an increase of the RM acres by 11.3 percent. Overall, the impacts of this alternative are less than those of Alternative 2.

As in Alternative 5, this alternative proposes Unit 56 that borders the boundary of MFNMW and the concerns are the same. The North Saddle Lakes area would remain RN and the Puzzle Lake area would remain SPNM, retaining their attractiveness as potential recreation areas. Under Alternative 7 there would be a reduction of impacts in areas in SPNM and RN areas along Sea Level Creek.

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Impact of Alternatives on Recreation Places and Sites

Because data on the number of recreationists who use remote areas, such as the Project Area, is very limited, it is difficult to estimate how the alternatives would affect users of any specific recreation place. Because of noise, visual impacts, and the resulting change in the recreational setting, many existing recreation activities are incompatible with an active logging operation. Most of the current recreational activities occurring in recreation places rely on the natural appearance of the area. If a recreation place is entered for timber harvest, those activities that are incompatible will cease until the area returns to a natural setting.

The impacts to the recreation places and sites are based on the existing use that occurs and the potential for an area to be developed. A description of the existing recreation places that may be impacted and potential recreation places and sites are described in the following discussion.

Existing Recreation Places and Sites

An indirect effect of the action alternatives may be increased recreational and subsistence use in the vicinity of the logging camps and roads. This increased use would be predominately hunting, fishing, and gathering of forest products.

Throughout the Project Area, after harvest, people may use the road systems for recreation. These users may place increased pressure on the fish and wildlife resources. However, this use may diminish over time as alder slowly closes the roads to foot and all terrain vehicle traffic. Some of the roads will be closed after harvest is complete.



Fish Creek Cabin

Fish Creek

This recreation place is located at the northeastern end of Thorne Arm. Fish Creek is easily accessible from Ketchikan, Saxman and Metlakatla making it a popular place for both local and nonlocal visitors. There is a recreation cabin, two trails (Gokachin and Low Lake), and a mooring buoy available for public use. The cabin has beach access, fishing opportunities for both freshwater and saltwater fishing, and access to both trails. Both of the trails provide lake and stream fishing, hunting, scenic and wildlife viewing and access into MFNMW. The mooring buoy is located near the cabin site to provide safe moorage. In the immediate area there are opportunities for saltwater fishing, boating, and beachcombing. Only Alternative 2 proposes units directly across from the cabin site on the hillside approximately four miles away. Noise associated with logging activities may be heard at the cabin. This may impact visitors coming to this area desiring solitude and scenic landscape. There are existing units in this area that are visible from the cabin, including the extensive harvest on private land seen to the east. See the Scenic Resources section in this chapter for analysis of this area. Visible harvest along the travel route to this popular recreation site may impact the anticipated experience of those travelling to the site by boat or floatplane.

Sealevel Mine

This recreation place is located approximately one mile to the south of the Fish Creek Cabin and is approximately 1,425 acres in size. There is a mooring buoy that people use for a variety of activities. Currently, this area is used for fishing (saltwater and freshwater), hunting and boating. The abandoned Starr Lake trail is within this recreation place and due to the private land holdings there are no plans to develop this trail in the future. This trail at one time joined with the Gokachin Lake Trail that provides access into MFNMW. There are three parcels of private land equalling about 80 acres within the recreation place. This land is associated with the abandoned Sealevel Mine.

Alternatives 2 and 7 propose two units (120 and 121) with approximately two miles of new road through the southern edge this recreation place.

Remaining Places

The remaining recreation places are located within the Roaded Modified setting and impacts would not be significant under the proposed alternatives.

The adjacent recreation places and sites in MFNMW will maintain their current settings. Saddle Lakes and the Shelter Cove area will continue to be affected by ongoing timber harvest and road construction activities, though the former to a much lesser degree. The other recreation places within the Project Area which are now Roaded Modified will continue to move toward the roaded natural setting as second growth continues to mature.

Potential Recreation Places and Sites

Saddle Lakes

This recreation place is located on the northeastern end of the Project Area and is currently used primarily by people working out of Shelter Cove. With the proposal to link the existing road system to Ketchikan, this area could be developed into a destination recreation site, primarily a campground, picnic area and freshwater boat ramp. Alternative 2 proposes to place one unit within quarter mile of the lake, which would slightly impact the visual qualities of that area.

Puzzle Lake

This recreation place is located south of the North Saddle Lakes. Currently this area has limited access, but it could be developed to provide camping, picnicking, hiking, and hunting. No plans have been developed at this time. Along with Saddle Lakes, Puzzle Lake has the potential to be a destination recreation area if the road system is linked with Ketchikan. This recreation place has been classified as Semi-Primitive Non-Motorized because of its limited access. Alternative 2 proposes several units in this area that will change the current classification from SPNM to RM and a future desired condition of RN. Under this alternative, an access route is proposed that will almost reach the lake. This alternative may reduce the desire to place recreation facilities in this area because of reduced natural forest settings. Further plans could be developed to extend the road to the lake.

Snipe Point and Elf Point

Both of these sites are existing log transfer facilities (LTFs) that, if developed with a boat dock or mooring buoy, could provide opportunities for hiking and hunting. No plans have been created for developing these areas.

Cumulative Effects

By the year 2095, the recreation settings in the Project Area will move toward an emphasis of Roaded Modified and Roaded Natural ROS classes. Existing recreation place settings will reflect this change, and new recreation opportunities associated with roads will likely be present. A connected road network to the City of Ketchikan from the Project Area may occur within 10 years.

In the event of the Shelter Cove road connection, access to this area would increase substantially. This road connection may shift the current recreation use patterns from the Ketchikan area towards the center of the island. The opportunities for developed and dispersed camping, picnicking, hunting, hiking, boating, fishing, wildlife and scenic viewing, and winter recreation may make this a very popular recreation destination. There will be greater potential for:

- sites at both North Saddle Lakes and Puzzle Lake,
- a boat launching facility and dock at Shelter Cove, and
- dispersed opportunities in Carroll Inlet.

With increased roaded access, recreation users having expectations for natural appearing settings will either adapt to the changing conditions, use other areas on the Forest, or will no longer recreate on the Forest. Displacement to other natural areas may result in increased use and social encounters, and a reduction in the opportunities for solitude in those places. These changes are consistent with the analysis and projections in the TLMP Final EIS (1997).



Wild and Scenic Rivers: Affected Environment

Rivers eligible for inclusion in the Wild and Scenic River System on the Tongass National Forest were evaluated in the TLMP Final EIS (1997) as to their suitability for the National Wild and Scenic Rivers System. To be eligible, a river must be free-flowing, and contain at least one outstandingly remarkable value. There are no free-flowing stream systems within Sea Level Project Area currently designated in the National Wild and Scenic River System but the following has been recommended for inclusion in the 1997 Forest Plan.

The Gokachin, Mirror, Fish, and Low Creek system was determined to be suitable for designation as a Wild River (TLMP ROD, 1997). The system is outstandingly remarkable for its regional significance in fishery, wildlife, recreation, scenic, and historical/cultural values. The cultural or historical values in the river system are significant as well. Several prehistoric use sites are located along Fish Creek and the entire area is rich in mining history. A detailed analysis of this area can be found in the TLMP, Appendix E.

Figure Recreation-3 displays the location of this Wild River section. The river system consists of a stream, river, or lake itself and a quarter mile study area measured from its high water mark, on each side of the water course (total minimum width of a half mile); this area is called a corridor.

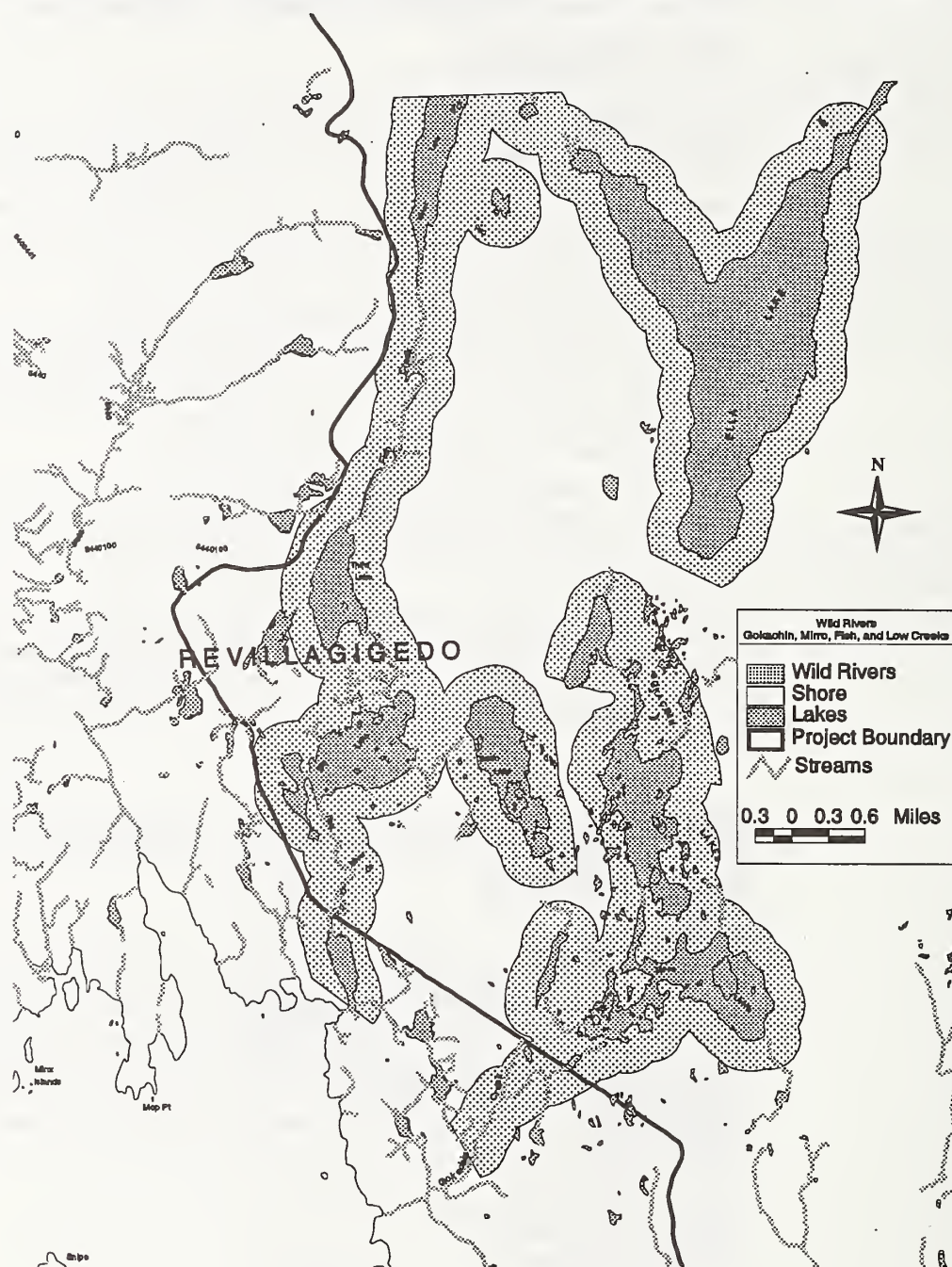
Sea Level, Painted, Marble, Licking, Calamity, Buckhorn and Gunsight Creeks were determined not to contain outstandingly remarkable values representative of the geographic province (TLMP Final EIS 1997). Therefore, they were not recommended for designation in the Wild and Scenic River system. This evaluation was reflected in the TLMP Final EIS (1997).

Wild and Scenic Rivers: Effects of the Alternatives

When the 1997 TLMP Record of Decision recommended the Gokachin, Mirror, Fish and Low Creek system for inclusion in the National Wild and Scenic River System, a quarter mile corridor was imposed from the high water mark of both streambanks. If Congress designates this as a Wild River, a management plan will be written to regulate activities within that corridor. Only Alternative 2 proposes Unit 46 and Unit 59 adjacent to and slightly within the corridor, where, coincidentally, it overlaps the Sea Level Project Area and MFNMW boundary (see Figure Recreation-4). Should these units be chosen for the Selected Alternative, these portions would be deleted.

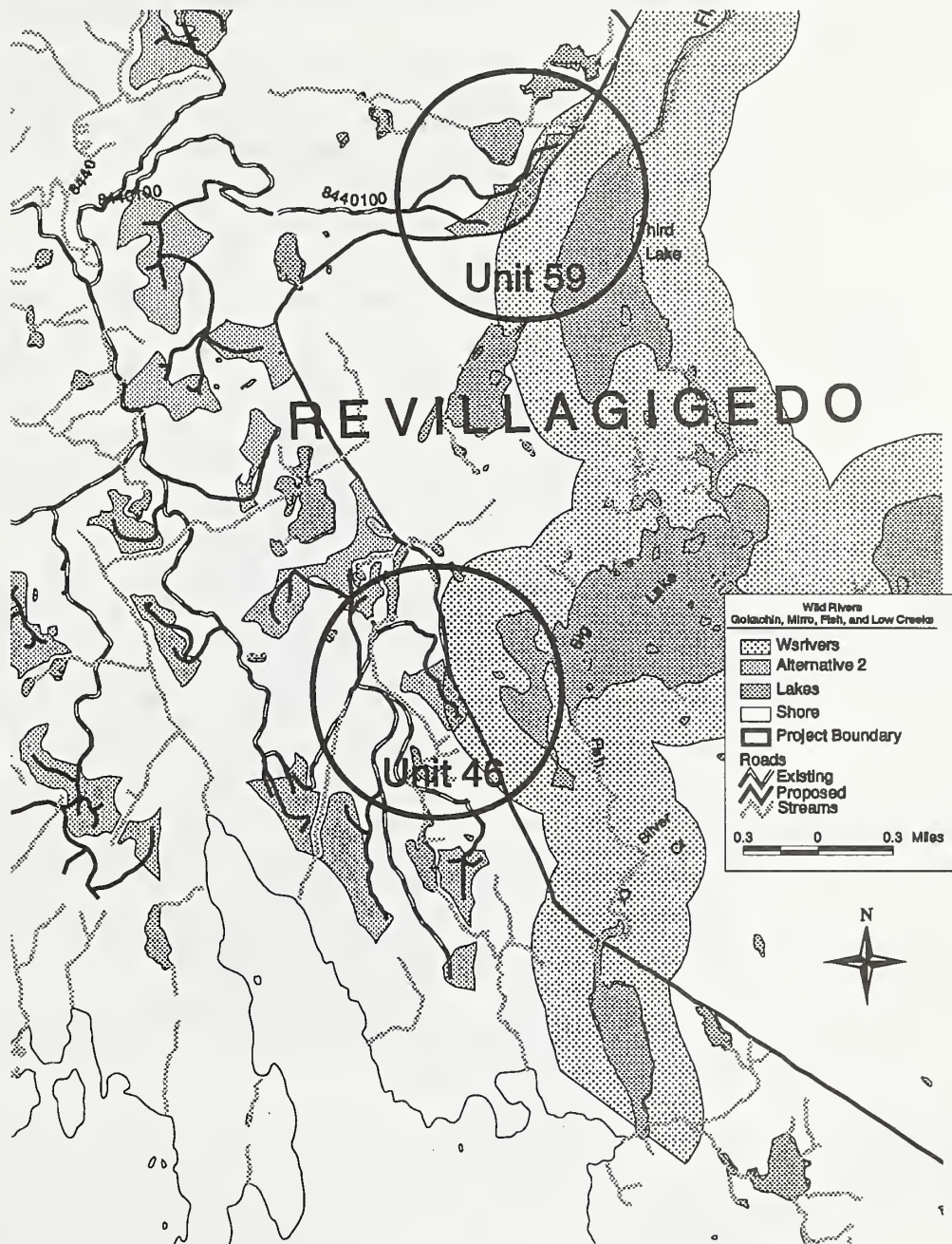
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Figure Recreation-3
Recommended For Wild and Scenic River System —Gokachin, Mirror, Fish, and Low Creeks



Source: Benson 1998

Figure Recreation-4
Alternative 2 - Portions of Harvest Units within Wild and Scenic River Corridor



Source: Benson, 1998

Roadless Areas: Affected Environment

Roadless Areas (RAs) are defined as areas in a National Forest or Grassland that meet minimum wilderness criteria, as defined by the 1964 Wilderness Act and its implementing regulations. To qualify, an area must contain at least 5,000 acres of undeveloped land which does not contain improved roads, maintained for travel by passenger-type vehicles. However, areas less than 5,000 acres may qualify if they are

- a self-contained ecosystem such as an island,
- contiguous to existing Wilderness, or
- ecologically isolated by topography and manageable in a natural condition.

Once an area is roaded it is generally no longer available for Wilderness designation. These Roadless Areas have been defined by the TLMP (1997) in Appendix C and not by the Roadless Area Review and Evaluation II (RARE II) process.

The Sea Level Project Area includes portions of the North Revilla RA-526, the Carroll RA-535, and the South Revilla RA-523 as identified in the TLMP Final EIS (1997). The following analysis evaluates the direct and indirect effects the alternatives may have on the roadless character and wilderness attributes of these three Areas.

North Revilla Roadless Area No. 526

Roadless Area-526 totals 217,818 acres of which 9,816 (4.5 percent) are within the Project Area. This roadless acreage includes all of the unroaded portions of the upper Marble Creek, Calamity Creek and Licking Creek watersheds. The majority of these drainages have been roaded and harvested through past activities. The remaining unroaded portions of these creek drainages consist of steep and rugged terrain. Both the Marble Creek and Calamity Creek portions of this roadless area border MFNMW and make up the southern section of the greater RA-526. There are no unique values to this area.

Carroll Roadless Area No. 535

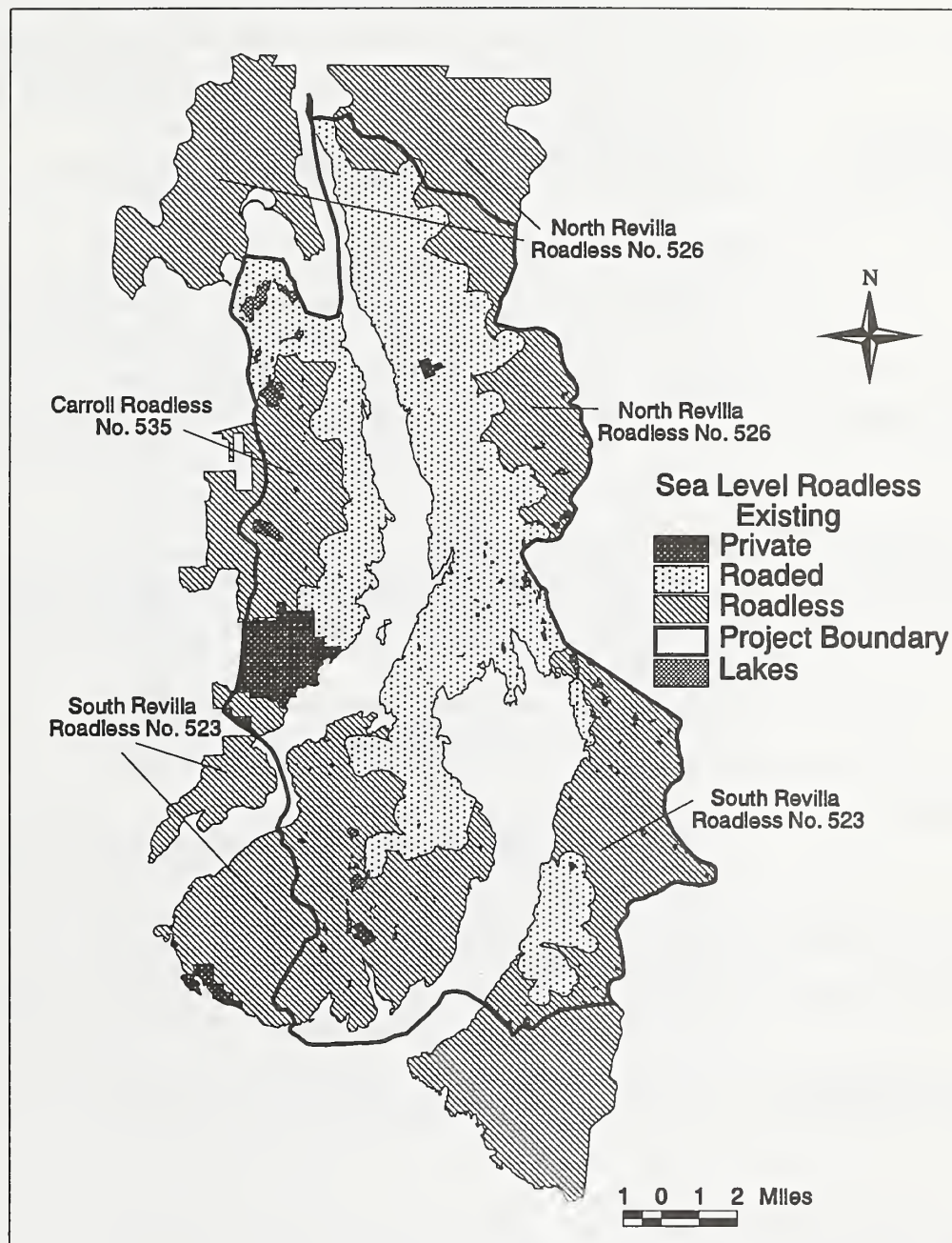
Roadless Area-535 is 11,671 acres, of which 7,892 (67.6 percent) are within the Project Area. This area, characterized by rugged terrain, steep mountain slopes and lakes, is located on the peninsula separating George Inlet and Carroll Inlet along the southwestern border of the Project Area. It is completely surrounded by past human activities - to the west and south, there has been continuous road building and timber harvest on the private lands of Cape Fox Corporation; and to the north and east, timber harvest and roads are present on National Forest system lands that make up the Project Area.

There are seasonal opportunities for solitude within certain parts of the area, but aircraft noise can be heard virtually everywhere year-round. However, there are many semi-primitive attractions still available. Because of these factors, RA-535 does not meet the Wilderness criteria.

South Revilla Roadless Area No. 523

Roadless Area-523 is 52,209 acres of which 29,880 (57.2 percent) are within the Project Area. This area is located in the southern portion of the Project Area from the boundary of MFNMW to the east shore of Thorne Arm; it covers the Black Mountain and California Head areas in the south to southwest. It is characterized by a combination of steep mountain slopes and gentle terrain. There has been some modification to the area by logging in the Elf Point and Snipe Point areas and through use by residents of Ketchikan, Saxman and Metlakatla. There is opportunity for solitude within certain parts of the area, but aircraft and boat noise can be heard virtually everywhere. Owing to the road network from the previous timber harvest, there are many semi-primitive motorized and non-motorized opportunities available. Because of these factors, RA-523 does not meet the criteria for consideration as Wilderness.

Figure Recreation-5
Sea Level Project Area Roadless Areas



Source: Benson, 1998

Roadless Areas: Effects of the Alternatives

In all action alternatives, timber harvest and road construction would directly and indirectly affect the roadless character and roadless attributes of the Project Area to varying degrees. The following discussion summarizes how the alternatives differ as to their effects.

North Revilla Roadless Area No. 526

Calamity and Licking Creek Drainages

The Calamity and Licking Creek drainages would not be affected by any of the action alternatives.

Marble Creek Drainage

The Marble Creek drainage, which has been roaded by past harvest in its lower portion, will be affected by Alternatives 2, 5 and 7 which propose additional harvest units. Alternative 2 would reduce the roadless area the most and Alternative 5 would reduce it the least.

Carroll Roadless Area No. 535

Gunsight Creek Drainage (Puzzle Lake) and Buckhorn Creek Drainages

All action alternatives propose additional timber harvest and roads in this Area, with Alternative 2 having the greatest impact and Alternative 5 having the least. This RA has high potential for development of roaded recreation which is a priority objective for Ketchikan area residents.

South Revilla Roadless Area No. 523

Sea Level Creek Drainage

Alternatives 2 and 7 propose additional timber harvest and roads in this Area. Alternative 2 has the greatest impact, with existing roads in the Elf Point area extended into it. Alternative 5, which proposes no units or roads in this drainage, would have no additional impact.

Black Mountain

Alternative 2 proposes additional timber harvest and roads in this Area. Existing harvest and roads in the Snipe Point area would be extended into unharvested areas. There are five units proposed in this area, two along the shoreline and three inland.

Summary

Roadless area reductions vary by alternative. Alternative 2 would reduce roadless area in the Project Area by 12,720 acres (-26.7 percent). Alternative 5 would reduce roadless areas by 2812 acres (-5.9 percent). Alternative 7 would reduce roadless areas by 2,811 acres (-5.9 percent). Some of these reductions are in drainages which have already been logged and roaded. Alternative 2 has the greatest impact breaking large sections of roadless area into segments, reducing the potential for Wilderness designation in Roadless Area No. 523 and No. 535. The TLMP's Land-Use Designation for these areas is Timber Production (TM) and Modified Landscape (ML) or commodity-producing areas. Therefore, the impacts on the roadless areas are consistent with the desired future condition in the Forest Plan.

Cumulative Effects

By the year 2095, there will be few roadless areas remaining in the Project Area except for the upper parts of the drainages and ridges that cannot be logged due to physical limitations.

Roads and Facilities

Key Terms

Access management—acquiring rights and developing and maintaining facilities needed by people to get to and move through public lands.

Arterial roads—usually developed and operated for long-term land and silvicultural purposes and constant service.

Collector roads—collect traffic from Forest Local roads; usually connect to a Forest arterial road or public highway.

Local roads—provide access for a specific resource use such as a timber sale or recreational site; other minor uses may be served.

Log transfer facility (LTF)—a facility that is used for transferring commercially harvested logs to and from a vessel or log raft, or the formation of a log raft.

Main trunk roads—primary roads that are used repeatedly for forest access over long periods of time.

Modular bridge—a portable bridge constructed of components that can be readily assembled and disassembled for movement from one site to another.

Prehaul maintenance—work performed prior to use of a road for timber harvest activities; includes blading, shaping, and brush removal.

Specified roads—constructed to remain on the permanent transportation system.

Temporary roads—short-term roads built for limited resource activity or other project needs.

Traffic service levels—traffic characteristics and operating conditions that are used in setting road maintenance levels.

Affected Environment

There are approximately 321 miles of Forest Service roads on Revillagigedo (Revilla) Island, 158 miles of which are within the Project Area. None of the roads connect to other existing road systems on Revilla Island and so are not maintained for passenger vehicles. These single-lane, rough-rock roads are primarily designed for heavy, off-highway logging trucks to implement silvicultural activities on the National Forest.

The transportation system can be broken into four categories: (1) State and municipal roads (all State and municipal roads are outside the Project Area), (2) private roads, (3) Forest Service roads, and (4) log transfer facilities (LTFs). The Project Area contains no public transportation facilities such as State highways, ferry dock, or airports.

Forest roads are designed to varying standards depending on use. The Forest Service transportation system includes three classes of roads: arterial, collector, and local. Arterial and collector roads are usually maintained for use by passenger vehicles and are designed with more emphasis on mobility than are local roads. Arterial and collector roads are generally mainline roads requiring higher standards and heavier financial investment to provide prolonged use. These roads can be built to lower standards initially and upgraded as use intensifies. Thus, the logging operator may construct arterial and collector roads to low or medium standards depending on use. Most local roads are not designed or maintained to

Forest Transportation System

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accommodate passenger vehicles. Local roads are generally single-purpose roads resulting in lower design standards and usually cost less than arterial and collector roads.

Construction of roads for timber-harvest activity varies from year to year. From 1990 to present, approximately 86 miles of local roads have been constructed on Revilla Island. These roads were constructed under the Shelter Cove Final Environmental Impact Statement (EIS) Record of Decision (ROD), the North Revilla Final EIS ROD, and the Upper Carroll Final EIS ROD.

Traffic-service levels portray the expected traffic characteristics for Forest roads (see Appendix E). There are approximately 8.6 miles of traffic-service-level C roads within the Project Area (road to Coast Guard station); the remaining miles are traffic-service-level D. All new road proposed for each alternative will be constructed as traffic-service-level D.

Maintenance Levels

Maintenance levels are based on the anticipated use of the roads. Because roads in the Project Area are isolated, intermittent off-road vehicular and foot traffic is expected.

Maintenance levels for the Project Area are as follows

- Maintenance Level 1 (traffic-service-level D)—Roads are closed or blocked by bridge removal, vegetative encroachment, or other closure methods and are monitored for resource protection.
- Maintenance Level 2 (traffic-service-level C)—Roads are maintained for high-clearance vehicles and monitored for resource protection.

During resource management activities, the roads will be maintained commensurate with the activity. After completion of the management activity, these roads will revert back to the above-mentioned maintenance levels.

Prehaul and posthaul maintenance consists of ditch cleaning, road-side brush removal, roadbed surface blading, and installation of minor pipes.

Road Design

Road design patterns are similar from one alternative to another due to the location of the resource being used, terrain characteristics, and development costs. Roads are located to minimize disturbance on the land, yet provide access to resources. Thus, road locations generally follow routes of favorable terrain.

Construction and Reconstruction of Roads

Road reconstruction consists of complete roadbed repairs, major culvert or bridge replacement (major drainage structures), roadbed realignment, and/or resurfacing. Some roads may have a combination of reconstruction and prehaul/posthaul maintenance in order to improve the road for harvest activities.

Construction and Reconstruction of Major Drainage Structures

Since the 1960s, timber-harvest activities have occurred in the Project Area. Until 1980, many of the drainage structures of the Forest transportation system were constructed from native materials which had a safe working life of 8 to 12 years. Most of the drainage structures built with native materials have since then been replaced. The existing road-system drainage structures were surveyed for fish passage in 1997. Those structures not providing required fish passage are to be replaced with adequate structures during reconstruction. On both new and existing roads, modular bridges and permanent culverts will be used. The section on road-condition surveys has more details on these structures.

In situations where roads cross Class III streams, temporary log-stringer bridges may be used and then removed upon completion of use. Temporary log-stringer bridges may also be used

on specified roads during road construction, prior to installation of the permanent structure, to facilitate timing and scheduling concerns.

Rock-Borrow Quarry Location and Status (Disposition)

Generally, rock-borrow quarries are located every 1 to 2 miles along roads. The quarry location is determined by quality of the rock sources, haul distances, development costs, frequency of entry, and aesthetic considerations. Rock quarries are located to avoid wetlands whenever practical. An allowance for rock quarries is included in the acres estimated for right-of-way (ROW) clearing (7.25 acres per mile).

Future need for rock resource in the Area will be evaluated. Some rock quarries are small and used once, while others are expanded during future road-building operations (if quality rock is available). Each quarry will be evaluated during the construction stage for availability of quality rock and feasibility of expansion. Rock quarries with expansion potential will be retained, particularly in situations where potential roads and timber harvest may be developed in the future, or where numerous roads radiate out from a point near a centralized quarry. Rock quarries near the ends of the road system will be closed and reclaimed by spreading stockpiled overburden on the floor of the quarry.

Log-Transfer Facilities

To date, the transportation of harvested timber on Revilla Island has required that the log bundles be removed from the log trucks, placed in the water, and rafted. Due to the isolated nature of the Project Area, log-transfer facilities (LTFs) will be required. There are three existing, permitted LTFs on the Project Area that will be utilized. Road connections between LTFs were considered and were found to have more adverse impacts on the environment than using the existing facilities. No new LTF's will be required. Further analysis of LTFs is discussed in the Marine Environment, Log-Transfer Sites and Related Facilities section of this chapter.

Effects of the Alternatives

The effects of the transportation system on other resources are considered in the sections in this chapter relating to those resources (e.g. geology, floodplains, scenic, aquatic, marine environment, etc.). This section focuses on the effects of each alternative on the transportation system and will be categorized as follows (1) construction costs, (2) road development, and (3) access management.

Construction Costs Table Roads-1 displays, by alternative, the miles of road constructed and reconstructed and the transportation development costs.

Table Roads-1
Transportation Development Costs (in MM\$*) by Alternative

	Alternative			
	1	2	5	7
New Construction Cost	0.00	11.36	3.78	6.96
Miles of New Construction	0.00	50.62	16.90	29.94
Reconstruction Cost	0.00	1.22	0.87	0.91
Miles of Reconstruction	0.00	24.30	17.40	18.03
Bridge Construction/Reconstruction Cost	0.00	0.50	0.50	0.50
Existing LTF Reconstruction Cost				
Shelter Cove	0.10	0.10	0.10	0.10
Shoal Cove	0.10	0.10	0.10	0.10
Elf Point	0.10	0.80	0.80	0.80
Total LTF Reconstruction	0.30	1.00	1.00	1.00
Total Construction and Reconstruction Cost	0.30	14.08	6.15	9.37

Source: Oien 1998.

* MM\$ = million dollars.

Road Development The spatial arrangement of resources and the amount of harvesting that would occur in new undeveloped areas requires changes in the planned road system. New roads are proposed in order to harvest the timber volume associated with each alternative. To harvest all suitable and available timber in the Project Area, a total of 117.6 miles of new road would be needed. The total miles planned are the roads needed to harvest the remaining timber volume in the rotation associated with each alternative.

Expansion of the road system requires: (1) construction of roads, (2) reconstruction of some existing roads, (3) construction and reconstruction of varying types of major drainage structures, and (4) coordination with other resource needs.

Table Roads-2
Transportation Systems (Miles)

Alternative	Existing Roads	Roads to be Used for Harvest	Proposed New Roads	Total Transportation System*
2	158	135.30	50.62	208.62
5	158	58.32	16.93	174.93
7	158	97.31	29.90	187.90

Source: Oien 1997

Note: Discrepancies may be found between tables due to rounding.

* Total Transportation System equals the existing roads plus proposed new roads.

Construction of Roads

Alternative 2 constructs the most miles and has the highest costs, while Alternative 5 constructs the least miles and has the lowest cost. The level of local road development is not directly proportional to the level of harvest in each alternative because of differing spatial arrangements of harvest units.

Reconstruction of Roads

Reconstruction of existing roads is associated with all action alternatives. Activities range from major realignment and bridge replacement to minor blading and shaping of the existing road.

Prehaul maintenance is not displayed in Table-1 Roads. It is assumed all roads require some minor surface blading, ditch cleaning and brushing prior to commencement of log-hauling operations.

Road Connections to Eliminate LTF sites

Road connections to eliminate LTF's were considered and are feasible, but the environmental effects of doing so were greater than the continued operation of the three existing, permitted LTF's.

Coordination with US Fish and Wildlife Service

In accordance with an agreement between the US Forest Service and the US Fish and Wildlife Service (USFWS), specific criteria concerning road construction within ½ mile of an active eagle's nest is implemented to mitigate disturbance to eagles. There are existing roads and planned roads within the ½ mile zone of known eagle nests on the Project Area. These areas are indicated on the road data cards.

Road construction is not anticipated to be within 330 feet of any inventoried eagle-nest trees in the Project Area.

Road Management Considerations

Streams

Road construction involves crossing streams, many of which are habitat for various fish species. It is necessary to minimize impacts on these streams to protect salmon fry and eggs. Maintaining passage for fish and scheduling construction activities around fish movements (fish timing) are methods used to mitigate impacts of road construction on fish populations, eggs and fry.

A fish stream is defined as any water flow accessible to fish and capable of supporting aquatic life. This includes, but is not limited to, Alaska Department of Fish and Game (ADF&G)

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catalogued streams and their tributaries up to impassable natural barriers. Freshwater systems above blockages may also support resident fish stocks. Evaluation and recommendations will be made by a fisheries biologist during stream surveys to determine the presence of fish or fish habitat.

Passage Requirements

The objective of providing fish passage is to not interrupt the natural migration of anadromous and resident salmonids. Fish populations depend upon a mixture of habitat types for growth and reproduction. The incorporation of fish-passage structures at stream crossings should be based on assessments of the life-cycle requirements of fish species, habitat quality, and the accessibility of sites to fish. Table Roads-3 displays passage requirements on all proposed roads planned for Alternative 7.

Table Roads-3

Streamcrossings with Passage Requirements and Fish Timing for the Proposed Roads in Alternative 7

Road Number	Milepost/Station Number	AHMU Class	Passage	Timing	Timing Dates
8340700	Station 8+88	II	X		
8340700	Station 18+34	II	X	X	June 15 to August 7
8400000 Elf Point	Station 1 + 06	II	X		
8400000 Elf Point	Station 32 +76	II	X		
8422100	Milepost 0.10	II	X		
8430080	Milepost 0.50	II	X		
8430082	Milepost 0.10	I	X	X	June 15 to September 1
8437000	Milepost 0.30	II	X	X	June 1 to August 7
8437000	Milepost 0.80	II	X		
8445000	Milepost 0.68	II	X		
8445000	Milepost 0.95	II	X		
8445000	Milepost 1.07	II	X		
8445000	Milepost 1.11	II	X		

Source: GIS and Micro-Habitat Stream Surveys

The choice of crossing location is very important in terms of both sedimentation and fish passage. Stream reaches with uniform alignment, good bank stability, and uniform gentle gradients are the easiest to cross and provide for fish passage.

Current Forest Service policy and direction is to provide for the passage of fish at all designated fish streams. Table Roads-3 lists streamcrossings in which fish passage is required for the Project Area existing roads.

Timing Restrictions

The seasonal timing of instream construction operations is most often prescribed as a resource protection requirement for Class I streams. Timing may be recommended for Class II and

sometimes Class III streams. Timing recommendations are based on the site-specific and downstream impacts to spawning, egg presence, fry emergence, and migration of smolts (BMP 14.6). The timing windows are listed in Table Roads-4.

Table Roads-4
Timing Windows for Instream Road Construction

Species	Timing Window
Pink/Chum	June 1 to August 7
Sockeye	July 18 to August 15
Coho	June 15 to September 1
Steelhead	July 18 to August 15

Source: AHMU Handbook

The window dates represent a period during which instream work can be conducted. For example, if pink salmon are present, all instream work must be done between June 1 and August 7. However, if both pink salmon and steelhead are present, the timing window is shortened to July 18 to August 7.

Timing windows are to be determined from a review of site-specific information. Variances from the general windows are allowed on a case by case basis, particularly with implementation of the appropriate mitigation measures as prescribed by fisheries biologists. Table Roads-5 lists the ADF&G catalogued streams subject to timing restrictions for instream road construction.

Table Roads-5
ADF&G Catalogued Streams that Will Require Instream Road Construction

ADF&G Stream Number	New Construction	Reconstruction	Alternative
101-43-10180	X	X	2
101-43-10410	X		2
101-43-10560	X		2, 7
101-45-10880	X	X	2, 5, 7
101-45-10880-2003	X	X	2, 5, 7

Source: ADF&G Stream Catalogue and Road Condition Survey 1997.

Generally, these restrictions can be accommodated through planning and scheduling of the construction activities. In many cases, additional costs would be incurred to accommodate the timing restrictions. Such costs would include additional equipment mobilization and demobilization, increased construction actions, and increased construction delays. It is estimated that approximately 250 feet of road are involved in crossing a Class I and II stream and buffer; 200 feet for the buffer crossing, and 50 feet for the stream-channel crossing.

Tongass Timber Reform Act (TTRA) Stream Zones

Roads will be located within stream zones (buffers) where it is the environmentally-preferred choice and where it is consistent with safety regulations. When these roads are designated on the ground, care will be taken to keep as much of the road as possible outside TTRA stream zones. In most cases, the limiting factor will be the type of terrain adjacent to the various stream zones, which will govern how much of a given road segment can be located outside these zones.

Wetlands

Peatlands, which include bogs and fens, are treated differently than other wetlands due to their great expanse on the landscape in Alaska. Experience has shown that roads can be built across peatlands with an overlay-construction technique; appropriate fill material such as rock, logs, wood chunks, wood chips, or geotextiles are used to construct a stable road base. Where practicable, standard road construction across peatlands excludes road-side ditches that would disrupt subsurface drainage patterns and create altered wetness conditions. Providing adequate cross drainage is an important consideration for maintaining natural runoff patterns. Wetlands will not be used for disposal of endhaul material.

The average ROW width is 60 feet and includes acreage for rock quarry sources (which are not usually in wetlands areas), and includes sideslopes from flat ground to full bench (55 percent plus). As wetlands generally occur on flatter slopes, where there is overlay construction, the width of the affected area is less than the average ROW width and clearing widths will vary from 20 to 30 (horizontal) feet wide depending on slope, horizontal and vertical alignment of the road, and other safety-related requirements.

For further information on wetlands, see the Floodplains and Wetlands section in this chapter 3.

Additional Recommendations for Management

Additional recommendations for design and maintenance of the road system to maintain riparian and wetland function and fish habitat include:

- Minimize the amount of new road construction through fens. Roads located on fens can impede the natural water movement associated with these areas and generally require a high density of drainage structures. Fens often contain numerous Class I and II channels that provide high-value fish habitat and will therefore require special passage and/or timing restrictions. Roads located within fens usually require high maintenance due to beaver activity.
- Avoid crossing active alluvial fan channel areas. Where possible, locate crossings at the apex of the fan where the stream is still relatively contained. If the fan must be crossed, extra and oversized drainage structures are recommended.
- Remove all drainage structures in sensitive areas where fish passage, beaver habitats, and unstable stream channels are a concern, unless routine road-drainage maintenance is feasible. Close all temporary roads and use water bars to control road drainage.
- Conduct annual inspections in accordance with criteria set forth in the Soil and Water Conservation Handbook and Monitoring Plan. Identify all existing and potential streamcrossing deficiencies and recommend corrective actions.
- Construction of roads, particularly mid-slope roads, in sediment source areas should be minimized. Roads in these sensitive areas have potential for accelerating large-scale mass wasting and have a high likelihood of direct sediment delivery to anadromous and resident-fish habitats.
- To ensure proper fish passage for anadromous and resident fish, install over-sized culverts where bridges are not feasible. Over-sized culverts should be buried enough for the stream to regain its natural streambed and to allow natural flows during high-water events.

State Land

No road or LTF development will take place within State lands.

Access Management

In all the proposed action alternatives, access to the road system is by boat or float plane. None of the road systems are connected to any community, public road system or ferry terminal. Due to these limits, vehicular use is expected to be negligible except for some use of off-highway vehicles while roads are open.

Options for managing traffic are:

1. Encourage use consistent with the conditions of the road and resource management direction.
2. Accept, but do not encourage, use by vehicles that are not suited for use on a specific road.
3. Discourage all public motor vehicles.
4. Eliminate use by physically blocking the road to all motor-vehicle traffic.
5. Prohibit motor-vehicle use by an order.

Roads are closed or blocked for numerous reasons including fish and wildlife protection, public safety, other resource protection, and inadequate maintenance funding. It may be necessary to close or block complete roads or portions of roads to use by specific vehicle types. Roads under Forest Service jurisdiction can be closed to motorized vehicles by authority of CFR 36, Ch.11, parts 212.7 and 261. Road-closure orders will be posted at the Ketchikan/Misty Ranger District office.

New roads proposed for this Project will be closed, blocked or obliterated at the termination of silvicultural activities in the Area. Some existing roads that are now open will be closed or blocked for a variety of reasons. Cost of maintenance of these roads is the primary reason for closure or blockage.

Road Disposition

Maintenance of the closed or blocked roads will consist of monitoring road and drainage structures for functional and environmental condition. Permanent drainage structures will be installed to meet long-term access objectives; however, maintenance levels fluctuate in response to changing uses. During periods of limited use, maintenance standards are sufficient to provide only for administrative use and resource protection. Postsale road-management objectives are to keep the road open for administrative activities and to facilitate maintenance for resource protection. Maintenance Level 1 will be applied to these roads, which will include waterbars to safeguard minor drainage structures. This measure will minimize erosion in the event of structure failure.

For roads to be closed, bridges will be removed (and used in other locations). The roads behind bridges will not be maintained for vehicular traffic; however, drainage structures will be monitored for functional condition. Maintenance Level 1 will be applied to these roads.

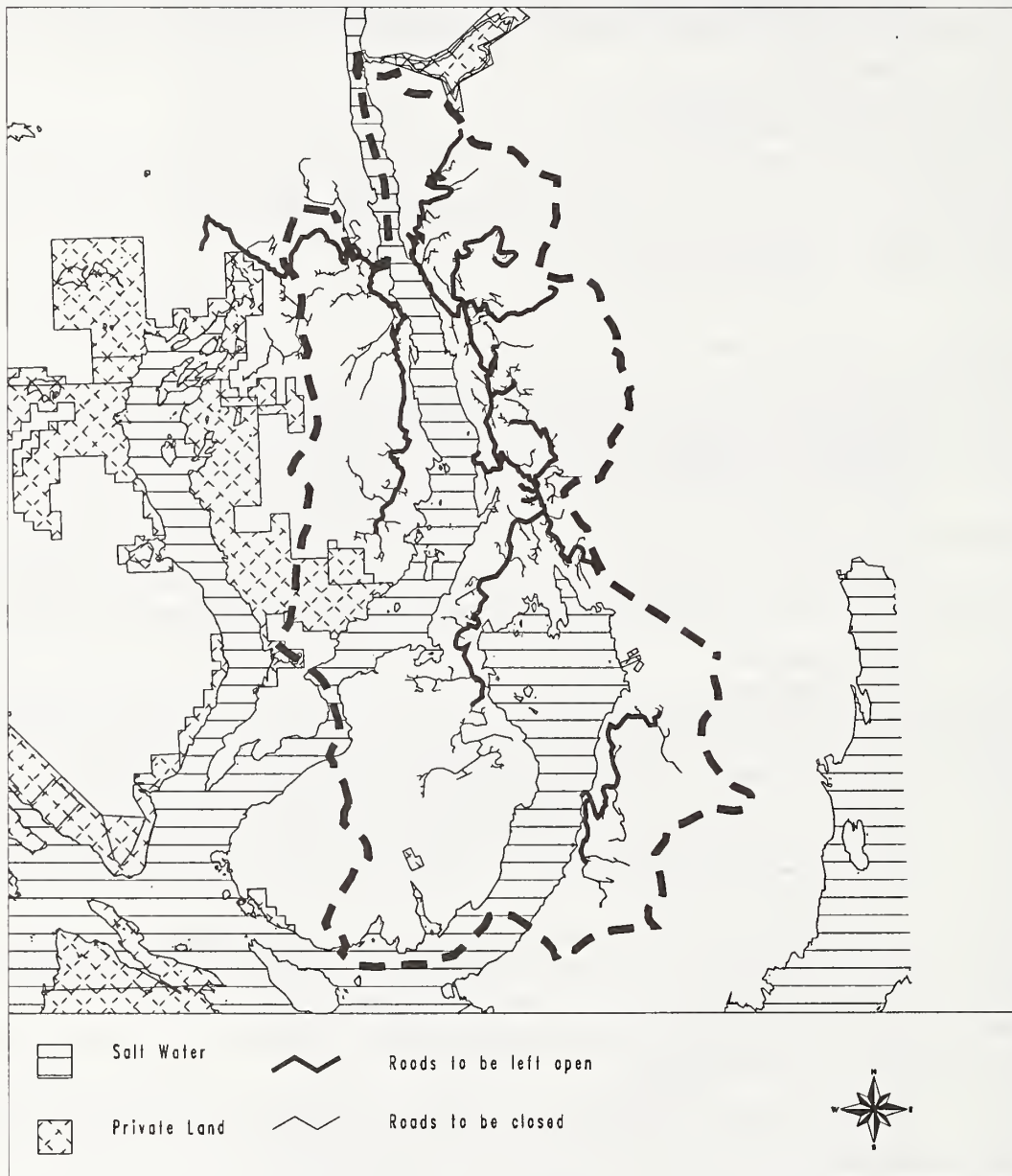
Roads to be obliterated shall have all drainage structures removed, the road waterbarred and seeded, and unstable cutslopes stabilized.

Temporary roads are not retained on the permanent transportation system. These roads will be closed by removing structures, construction of water bars and revegetation of the soil in accordance with National Forest Management Act.

Figure Roads-1 illustrates the roads to remain open with limited maintenance and the roads to be closed. The summary of road management objectives, containing the specific disposition of all existing and proposed roads, including the mileposts of existing roads where closure will be, is in Appendix E.

3 Environment and Effects

Figure Roads-1
Road Condition Survey



Road Condition Survey

In 1996-97, Ketchikan Ranger District fisheries personnel initiated a road-condition survey to identify general maintenance concerns for the Shoal Cove road system. The Shoal Cove road system currently has approximately 65 miles of existing roads. Using a modified version of the Petersburg Ranger District road survey, approximately 42 miles of existing mainline and lateral roads were surveyed in the Shoal Cove Area. They were chosen to be surveyed based on the number of streamcrossings, and which had highest maintenance concerns.

All road segments that did not have road-condition surveys completed in Shoal Cove, Shelter Cove and Elf Point areas were inspected in 1998 by District fisheries personnel and Area transportation engineers. All drainage structures on these road segments were inspected to identify any critical maintenance concerns that directly affect fish passage and downstream fish habitat (see Road Maintenance Strategy).

The objectives are to

- identify maintenance concerns that directly affect fish passage and fish habitat,
- prioritize and identify maintenance levels for each road, and
- identify and update all fish streams that were not previously documented in the Ketchikan Area road logs.

The road-condition survey completed in the Shoal Cove Area collected information on a variety of parameters related to roads and their affect on fish passage, habitat and water quality. Information collected includes

- location and size of all culverts and bridges installed for intermittent and perennial streams; all structures are identified and mapped by milepost (taken off road-condition surveys),
- general condition of culverts including: barriers to fish passage, percent damage, percent plugging and diversion potential,
- potential sediment sources to downstream fish habitat by roads, and
- update of the Aquatic Habitat Management Unit classes for fish passage and water-quality crossings for each road (see the Sea Level EIS planning record for the Road Condition Survey Data Dictionary and Data).

Table Roads-6
Road Condition Survey Information (Shoal Cove Mainline Road System Including Lateral Roads)

Road Segments ¹	Mainline Miles	Lateral Miles	Miles Surveyed ²	Passage Required	Passage Failures	Water-Quality Crossings	Water-Quality Failures ³
8400000	14.00	4.97	12	11	4	19	1
8430000	13.18	4.96	18	14	6	45	12
8435000	1.79	0.50	2	1	1	8	0
8440000	3.54	2.47	6	2	1	25	2
8444000	4.00	1.55	4	2	1	22	4
8446000	5.00	1.00	0	2	1	0	0

Source: Road Condition Surveys 1996-1997.

1 Includes mainline roads plus lateral roads within each road segment.

2 Total miles of mainline and lateral roads surveyed.

3 A water quality failure means that heavy equipment will be required for repair/replacement.

Road Maintenance Strategy

Road Condition Surveys (1996-1997) and Culvert Inspections (1998) conducted by District fisheries personnel and Area engineers identified streamcrossings and road segments that are currently failing to provide fish passage or accelerating fine sediment to downstream fish habitat due to culvert damage and road-prism failures.

A total of 40 streamcrossings were identified as requiring fish passage in the Shoal Cove, Shelter Cove and Elf Point areas. Of the streamcrossings requiring fish passage, 19 crossings were identified as failing to provide fish passage. Table Roads-8 lists the streamcrossings by road number, milepost and Aquatic Habitat Management Unit (AHMU) Class that require fish passage.

The rationale for determining whether or not a drainage structure allows fish to migrate upstream and downstream of the streamcrossing involved an individual survey completed on each crossing. Factors included: water depth, rate of water velocity, size of structure, and placement of each structure. Fish-passage failures identified were primarily the result of undersized and incorrect placement of the culverts, which caused perching in excess of 1 foot.

In addition, five road segments were identified as having critical maintenance concerns due to road-prism failures caused by culvert blockage and/or damage. Table Roads-7 highlights the road segments with culvert and road-prism failures. These road segments identified as having failures are all located adjacent to, or above, Class I and II fish habitat.

Table Roads-7
Road Segments Identified with Extensive Culvert and Road-Prism Failures

Road Number	Total Miles
8430000	5.00
8430500	1.70
8430550	0.50
8430600	0.71
8444000	2.50

Source: Oien 1998.

Several funding sources will be used to complete the maintenance, identified as critical through the Road Condition Surveys. Due to the number of streamcrossings and road prisms identified as having critical maintenance concerns, and the available funding, the completion of all maintenance will begin in fiscal year (FY) 1999 and will end upon completion of the timber sale. For information on site-specific maintenance to be implemented on streamcrossings and road segments, refer to the roads cards listed in the Record of Decision.

All maintenance planned will take care of negative effects on fish streams due to the existing roads. All existing streamcrossings that have been identified as not providing proper fish passage will be replaced with either counter-sunk culverts or bridges, depending on the size and channel type associated with each crossing. Approximately 11 miles of spawning and rearing habitat for anadromous and resident salmonids will be made available upon replacement of existing culverts with structures that allow for proper fish passage, upstream of the crossings.

All road segments that have been identified as having extensive culvert failures and road prism failures will be storm-proofed through the removal of all drainage structures and slope stabilization on all cut banks.

3 Environment and Effects

Table Roads-8
Streamcrossings that Require Fish Passage for Existing Sea Level Roads

Road Number	Milepost	AHMU Class (TTRA)	Passage/Failure	ADF&G Stream Number
8340000	0.39	II	Passage	
8340000	0.50	II	Failure	
8340000	2.56	I	Passage	101-45-10730
8340000	2.70	II	Failure	
8340000	9.70	I	Passage	101-45-10670
8400000	24.25	I	Passage	
8400000	26.81	II	Failure	
8400000	28.59	I	Passage	101-45-10880
8400000	29.61	I	Failure	101-45-10880-2003
8400000	32.89	II	Passage	
8400000	33.77	II	Failure	
8400000	34.78	II	Passage	
8400000	35.10	II	Passage	
8400000	36.19	II	Failure	
8400000	37.16	I	Passage	101-45-10850
8430000	1.04	II	Failure	
8430000	1.49	II	Passage	
8430000	2.67	I	Passage	
8430000	4.08	I	Passage	101-45-10230
8430000	4.20	I	Passage	
8430000	4.27	I	Passage	
8430000	6.46	II	Passage	
8430000	6.84	II	Failure	
8430000	8.11	II	Passage	
8430000	8.18	II	Failure	
8430000	8.51	II	Failure	
8430000	10.46	II	Failure	
8430000	11.15	II	Failure	

Continued on next page

Table Roads-8, continued

Streamcrossings that Require Fish Passage for Existing Sea Level Roads

Road Number	Milepost	AHMu Class (TTRA)	Passage/Failure	ADF&G Stream Number
8400000 Elf Point	11.10	II	Passage	
8400000 Elf Point	13.78	II	Failure	
8400350	0.35	II	Passage	
8430050	0.11	II	Failure	
8430200	0.17	II	Passage	
8435000	0.03	II	Failure	
8440000	2.15	I	Failure	101-45-10880
8440000	1.90	I	Passage	101-45-10880
8444000	0.04	II	Failure	
8444000	3.14	II	Passage	
8446000	4.55	II	Passage	
8446000	4.59	II	Failure	

Source: Road Condition Survey 1997 & Ketchikan Area GIS Stream Layer.

3 Environment and Effects



Scenic Resources

Key Terms

Cumulative Visual Disturbance (CVD)—the sum of all scenic effects created by all landscape alterations that are visible at a given point in time.

Distance Zone

Foreground—the detailed landscape found within 300 feet to ½ mile from an observer.

Middleground—the space between foreground and background in a picture or landscape. The area located from ½ to 4 miles from the viewer; often the most critical zone for scenery management; form, texture, and color remain dominant, and pattern is important.

Background—the distant part of a landscape; from 4 miles to the horizon from the viewer; line, form and pattern are the dominant visual characteristics.

Viewshed—a distinct area of land visible from important travelways (boat route, trail) or use areas (recreation cabin, anchorage).

Visual Condition (VC)—a measure of the magnitude of human-caused deviations in form, line, color, and texture from attributes of the natural or natural-appearing landscape. Visual condition is used to describe an existing situation (EVC) or a desired future condition (FVC). Defined in terms that closely correlate with VQOs listed below.

Level I - Unaltered—areas where only ecological changes have taken place. Corresponds to the preservation VQO.

Level II - Imperceptibly altered—management activities are not visually evident to the casual forest visitor. Corresponds to the retention VQO.

Level III - Slightly altered—management activities may be evident, but must remain visually subordinate to the natural or natural-appearing landscape character. Corresponds to the partial retention VQO.

Level IV - Moderately altered—management activities may dominate the landscape character, but at the same time, appear as a natural occurrence when viewed in the middleground or foreground zone. Corresponds to the modification VQO.

Level V - Heavily altered—management activities may dominate the landscape character, but should appear as a natural occurrence when viewed as background. Corresponds to the maximum modification VQO.

Level VI - Drastically altered—human-caused deviations that glaringly dominate the natural or natural-appearing landscape. An unacceptable visual condition. Does not meet any minimum visual objective.

Visual Quality Objective (VQO)—management direction that sets measurable limits on degrees of human-caused alterations and management activities; is based on a landscape's diversity of natural features and the public's sensitivity for high scenic quality.

Affected Environment

Introduction

An important aspect of Southeast Alaska's natural resource base is its attractive setting. The importance of the scenic character of a landscape area is evident by increased tourism and a heightened awareness of and sensitivity to scenic resource values by Alaska's residents and visitors alike. Because of this public concern, the "visual landscape" has been established as a basic resource of the land, and receives consideration along with the other forest resources.

The Visual Management System (VMS), developed by the Forest Service in 1976 and revised in 1996, inventories these scenic or visual resources and provides measurable standards for their management. The VMS deals with the visible aspects of the land and the design of human activities occurring on it. The VMS provides an overall framework for the orderly inventory, analysis, and management of scenery (Landscape Aesthetics: A Handbook for Scenery Management, 1996). This inventory and analysis system applies to every acre of National Forest System lands and all activities administered by the Forest Service.

Project Area Scenic Analysis

Landscape Character and Variety

On the Tongass National Forest, landscape character can be described as an overall visual impression of its landscape attributes—the physical appearance of a landscape that gives it an identity and "sense of place" or "lay of the land". Landscape character gives a geographic area its image. These areas or types of landscapes are distinct geographic units of land, each having distinguishing visual characteristics of landform, rock formations, waterforms, and vegetative patterns.

A landscape can be described by inventorying its physical features—terrain, geologic, water, and vegetative patterns. The Sea Level Project Area is typical of the Coastal Hill landscape character type. The Project Area consists of a deeply incised island with two major north-to-south waterways—the lower and middle portions of Carroll Inlet and all of Thorne Arm. The western boundary is dominated by a 1,000- to 2,000-foot ridge that separates Carroll Inlet from George Inlet. The eastern boundary matches the Misty Fiords Wilderness Area boundary. The southern boundary is formed by a combination of Revillagigedo Channel (the main cruise and tour ship route along the Inside Passage), and the northern boundary of VCU 760. The northern Project Area boundary matches with the southern boundary of VCU 747 and VCU 745 (State of Alaska - Swan Lake hydroelectric generation facility).

Prominent physical features of the Project Area can be described as follows:

Terrain Features - characterized by moderately diverse rounded to occasionally blocky terrain created from ancient glaciation—rounded, hummocky summits, knobs, and ridges. Generally steep landforms to saltwater and an irregular rounded appearance are characteristic of the terrain (Middle Carroll Inlet and Lower Thorne Arm).

Vegetative Patterns - dense conifer cover is prevalent; however, many small muskeg areas dominate the lowlands (Minx Flats area—between Upper Thorne Arm and Lower Carroll Inlet; adjacent to Fish Creek cabin). Some variation in color and texture can be expected, although this character type is dominated by few major plant cover types.

Project Area Viewsheds

To assist in the design of harvest areas and provide a systematic way to analyze and display the impacts of different alternatives, several viewsheds were identified. These viewsheds are discrete areas defined by logical terrain features such as major ridges or other landform features. Computer-generated perspectives from several representative viewpoints were developed within these viewsheds using PC New Perspectives and ArcInfo to help analyze

the visual impacts of the various alternatives. The alternative effects analysis is based on the viewsheds (See Figure Scenic-1 for viewshed locations) listed below:

1. Saddle Lakes recreation area
2. Middle Carroll Inlet
3. Lower Carroll Inlet
4. Fish Creek cabin & anchorage
5. Upper Thorne Arm
6. Lower Thorne Arm

In the following sections, these six viewsheds will be described in terms of their existing visual condition (degree of visual disturbance) and the Forest Plan visual quality objectives (VQOs). The environmental consequences section will then describe the visual impacts of each alternative on these viewsheds.

Visual quality objectives are a set of measurable standards for management of National Forest landscapes. They are: Preservation (P), Retention (R), Partial Retention (PR), Modification (M), and Maximum Modification (MM), and are defined in the Glossary (Chapter 4). Except for Preservation, each describes a different degree of potential, but acceptable, levels of human-caused alteration of the natural landscape. Degree of alteration is measured in terms of visual contrast with the surrounding natural landscape. Over time, visually altered forest landscapes return to a natural appearance.

The 1997 TLMP established visual resource management goals to be implemented in each land use designation (LUD) on the Sea Level Project Area (see Table Scenic-1). These goals are referred to as adopted VQOs, and are derived from a combination of two factors:

- whether a landscape area can be seen from a Visual Priority Travel Route and Use Area (VPR) designated in Appendix F of the 1997 TLMP; and
- the distance zone between the area being viewed and the viewer (see Key Terms).

1997 Forest Plan Visual Quality Objectives (VQOs)

Table Scenic-1
Adopted Visual Quality Objectives, by Distance Zone and Land-Use Designation

Project Area Land Use Designations	Adopted VQO by Distance Zones (as seen from a Visual Priority Travel Route and Use Area)			
	Foreground	Middleground	Background	Not seen from Visual Priority Route/Area
Old-Growth Habitat	Retention	Retention	Retention	Retention
Semi-Remote Recreation	Partial Retention	Partial Retention	Partial Retention	Partial Retention
Scenic Viewshed	Retention	Partial Retention	Partial Retention	Maximum Modification
Modified Landscape	Partial Retention	Modification	Modification	Maximum Modification
Timber Production	Modification	Maximum Modification	Maximum Modification	Maximum Modification

Source: TLMP 1997.

Visual Priority Travel Routes and Use Areas

The 1997 TLMP identified priority viewpoints from which scenery will be emphasized. These viewpoints are used to assess the existing visual condition of any given project area and to develop project designs that will be consistent with the adopted VQOs for each Land Use Designation (LUD).

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Priority Saltwater Use Areas

Carroll Inlet and Thorne Arm (from Ketchikan, 32 and 37 miles, respectively) are classified as saltwater use areas. These waterways are used extensively by local sport and commercial fishing boats from nearby Ketchikan, Saxman, and Metlakatla.

Priority Inland Recreation Use Areas

The Saddle Lakes area is a future recreation complex near Shelter Cove on Carroll Inlet and is the only inland recreation site in the Project Area; although it is considered a potential or planned use area in TLMP. This area is currently road accessible for ATVs or four-wheel drive vehicles brought in by boat via the Shelter Cove log transfer facility (LTF) on Carroll Inlet. However, due to a potential road connection to the population center of Ketchikan, recreational use is expected to increase in the foreseeable future (within ten years).

Priority Shoreline Recreation Use Areas

The Fish Creek cabin and associated mooring buoy at the mouth of Fish Creek is defined as a priority shoreline recreation use area.

Project Area VQOs

The VQOs for the Sea Level Project Area are consistent with the Forest Plan (TLMP 1997). The visual quality objectives and LUDs for the six project area viewsheds are listed below.

Saddle Lakes Recreation Area

This area is within the Project Area's only Scenic Viewshed LUD. Its visual management prescription is Retention VQO in the foreground distance zone and Partial Retention VQO in the middleground.

Middle Carroll Inlet (south of Shelter Cove)

This area is a combination of Modified Landscape LUD and Partial Retention VQO in the foreground, Modification VQO in the middleground and Timber Production LUD - Maximum Modification VQO in certain middleground areas.

Lower Carroll Inlet (south of Shoal Cove)

Modified Landscape LUD - Partial Retention VQO in the foreground and Modification VQO in the middleground; Timber Production LUD - Maximum Modification VQO in certain middleground areas. The visible southwest portion of viewshed is private land extensively harvested 8-10 years ago.

Fish Creek Cabin and Anchorage

As seen from this viewpoint, the proposed harvest areas would occur on all middleground landscapes nearly 4 miles across north Thorne Arm where a Modified Landscape LUD zone is visible along the shoreline - a Modification VQO. The Timber Production LUD upslope of that Modified Landscape LUD has a Maximum Modification VQO.

Upper Thorne Arm

A combination of two natural setting LUDs: (Old-growth Habitat) - Retention VQO in both foreground and middleground; and (Semi-Remote Recreation) - Partial Retention VQO in both foreground and middleground. It also combines two developmental LUDs (Modified Landscape) - Partial Retention VQO in the foreground and Modification VQO in the middleground; and (Timber Production) - Modification VQO in the foreground and Maximum Modification VQO in the middleground.

Lower Thorne Arm

On the western shoreline, a combination of a natural setting LUD (Old-growth Habitat) - Retention VQO both foreground and middleground; and a developmental LUD (Modified Landscape) - Partial Retention VQO in the foreground and Modification VQO in the middleground.

Existing Visual Condition of Project Area

On the eastern shoreline, the commodity oriented development LUD of Timber Production - Modification VQO in the foreground and Maximum Modification VQO in the middleground.

Existing Visual Condition (EVC) represents the degree of visual modification or disturbance presently occurring on the ground. Similarly, Future Visual Condition (FVC) represents the visual condition level that would occur at the end of a proposed activity period (including what presently exists). Both are measured in terms of condition types as described in the Key Terms (Levels I - VI) at the beginning of this section. Existing and future visual condition levels may also be described in terms similar to those used to describe VQOs. Additionally, visual modification levels of viewsheds can be described in a similar manner.

An existing visual condition analysis can be used to: (1) compare a viewshed's actual condition (current degree of alteration) with a project's adopted VQOs; (2) assess cumulative visual impacts of alternatives; and (3) determine whether the proposed management activities or facilities will maintain or change the present conditions, lower the scenic quality, or meet/not meet a project's VQOs.

The landscape character and EVC of the Project Area viewsheds are described below.

Saddle Lakes Recreation Area Viewshed (1,600 acres)

This viewshed has a closed-in bowl character with a mainline road at the base of even steep slopes. All views are foreground with a natural to slightly altered appearance from the road.

Middle Carroll Inlet at Shelter Cove (12,045 acres)

Closed canyon, steep sided, close-in views

- A. Northeast View - Marble Creek - heavily altered appearance
- B. Southeast View - Painted Peak - moderately to heavily altered appearance

Lower Carroll Inlet at Shoal Cove (9,167 acres)

Open terrain, close-in to distant and crossover views (views into other viewsheds)

- A. Northeast View - Painted Peak - heavily altered appearance
- B. Northwest to West View - moderately to heavily altered appearance
- C. Southeast View - Eve Point - moderately altered appearance

Fish Creek Cabin and Anchorage (1,793 acres)

Open terrain, middle to distant views, crossover views

- Southwest View - Eve Point - heavily altered appearance

Upper Thorne Arm (6,620 acres)

Open terrain, middle to distant views, crossover views

- A. North View - Fish Creek Cabin - slightly altered appearance
- B. Southeast View - Elf Point - slightly altered appearance

Lower Thorne Arm (4,980 acres)

Close-in, steep-sided canyon landscape character, close-in views

- A. Northwest View - Eve Point - unaltered appearance
- B. Southeast View - Elf Point - moderately altered appearance

There are 34,412 viewshed acres (38 percent) within the Project Area, of which 6,038 seen acres (or 18 percent) of the viewsheds have been harvested since the middle 1960s. Although the majority of second-growth is 20 to 40 years old and 25 to 40 feet high, it is still noticeable when viewed as foreground and close-in middleground due to variations in topography, harvest unit shape and location, and mature-stand backline edge contrasts. Vegetation texture and color differences account for definitive edge separations as well.

3 Environment and Effects

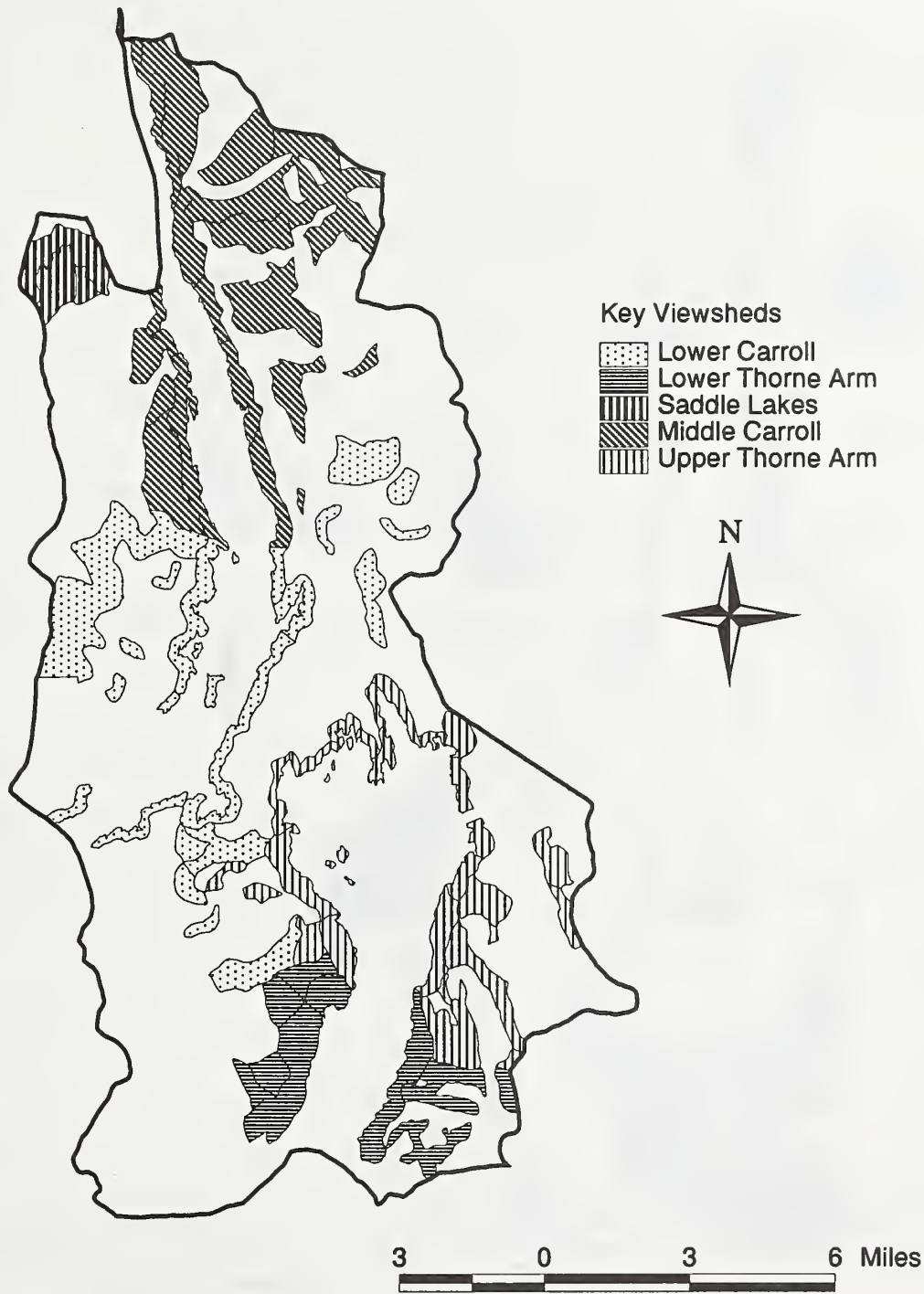
Private Lands

A major factor affecting the visual condition in this Project Area is the extensive timber harvest and road system on private lands on the prominent slopes and ridges at the south end of the peninsula between George Inlet and Carroll Inlet. The scale of this expansive harvest (beginning in the late 1980's and continuing) clearly dominates easterly views from the nearby Lower Carroll Inlet, Upper Thorne Arm, and Fish Creek Cabin viewsheds.

The appearance of this easily noticed clearcut may influence a casual forest visitors' impression of existing and proposed harvest on adjacent National Forest System lands. This existing private harvested area will directly affect the cumulative visual disturbance level. Any proposed Forest Service harvest should not be noticeable in order to avoid adding to the unacceptable existing visual condition. In addition, it is clearly visible from the major cruise ship route in Revillagigedo Channel (south of and adjacent to the Project Area) and from the popular saltwater sport fishing areas near Mountain Point and Herring Bay.

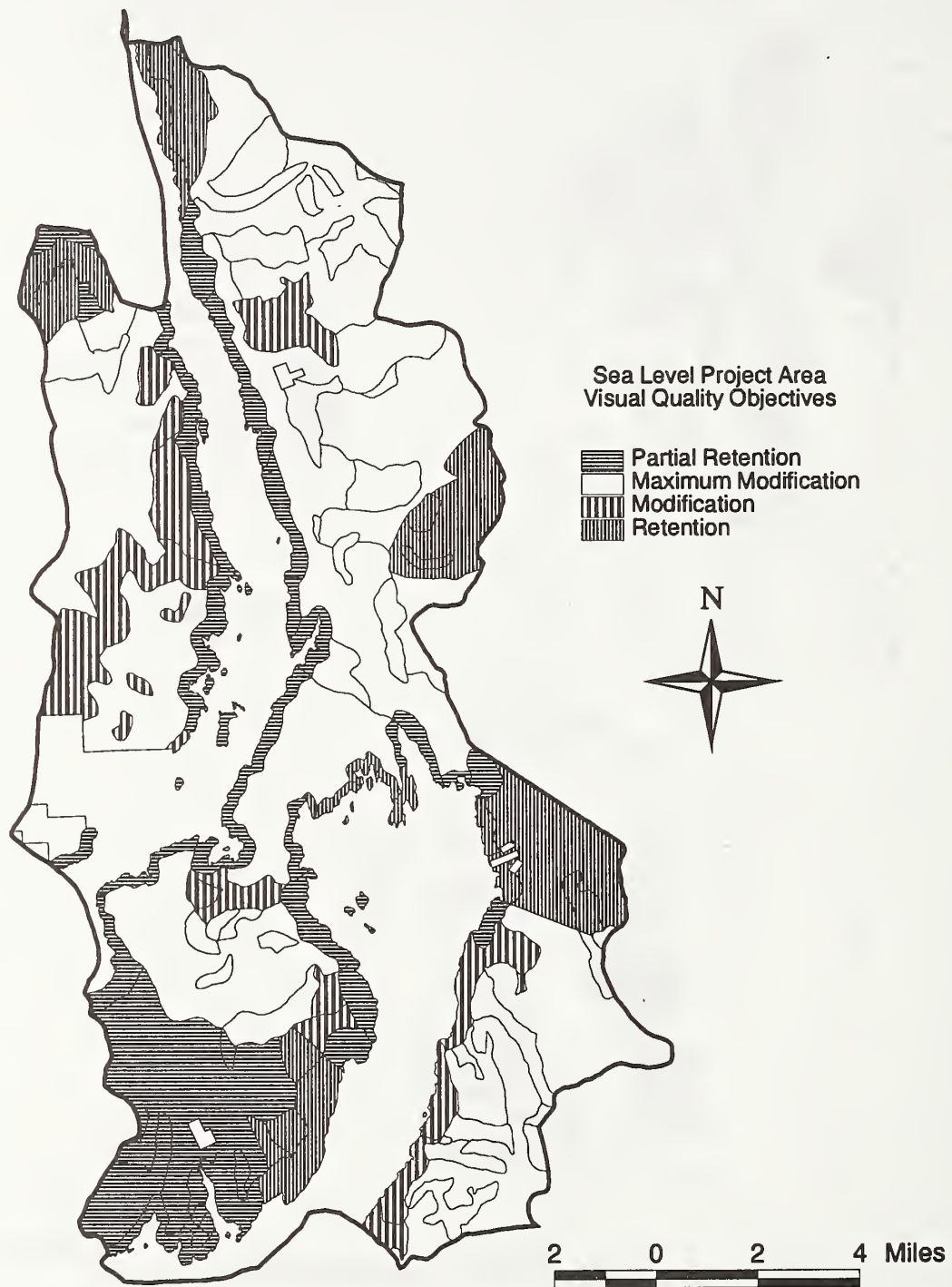
The following map, Figure Scenic-1, Project Area Viewsheds, illustrates the visible terrain in the Project Area.

Figure Scenic-1
Project Area Viewsheds



3 Environment and Effects

Figure Scenic-2
Sea Level Project Area Visual Quality Objectives



Effects of the Alternatives

Individual Viewsheds

The following discussion will cover the visual impacts of the proposed action alternatives within the six identified viewsheds of the Sea Level Project Area. The discussion order for the Carroll Inlet area is geographically southward from the Saddle Lakes Recreation Area to Lower Carroll Inlet, then crosses over into Upper Thorne Arm at the Fish Creek cabin site, finally ending at the Lower Thorne Arm viewshed.

Although computer-assisted viewshed analyses were plotted, none are displayed in this section due to the majority of harvest being proposed as Individual Tree selection or other partial harvest techniques. The area with the most exposed clearcuts (patch cuts) is the southeastern shoreline of upper Thorne Arm viewshed, north of Elf Point, Units 118, 119, 120 and 120 (proposed in Alternatives 2 and 7). However, this area meets the Modification and Maximum Modification VQOs for the Timber Production LUD, the most permissive of the Forest Plan land-use designations.

The following table, Scenic-2, displays the visible units and visible acres per action alternative. Alternative 2 proposes the most visible units and acres (51 units or 1,202-acres), while Alternative 5 proposes the least (14 units or 305 acres). The Fish Creek cabin viewshed is not shown.

All proposed units in all of the action alternatives would meet the adopted VQO's.

Table Scenic-2
Visible Harvest Units and Visible Acres per Alternative

	Alternative					
	2		5		7	
Average Visible Unit Size	23.6		21.8		23.9	
Viewshed Name	Units	Acres	Units	Acres	Units	Acres
Saddle Lakes	1	45	0	0	1	45
Middle Carroll Inlet	12	228	3	43	7	160
Lower Carroll Inlet	21	699	10	274	13	321
Upper Thorne Arm	13	373	1	14	9	191
Lower Thorne Arm	4	113	0	0	4	73
Project Area	51	1202	14	305	32	764

Source: GIS, Angelus 1998.

Note : Visible harvest acres reflects a plan or "birds-eye" view measurement. Actual visible acres are less because they are viewed in the perspective view (i.e., from a boat deck or beach cabin). Terrain features and forested vegetation help block most of the visual impacts of timber harvest and constructed roads. For example, Alternative 2 in the Saddle Lakes viewshed with a Visual Quality Objective of Retention (no alteration to be visibly evident would normally preclude a harvest unit 45 acres in size, but the proposed location is mitigated by terrain and vegetation screening.

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Saddle Lakes Recreation Area Viewshed

This 1,600-acre inland use area viewshed has an undisturbed natural appearance from the lake surface except for a 24-foot wide (recreation standard) gravel road skirting the north side of the largest lake and the south shore of the smallest lake. At some point in the future, this road may be joined with a "missing link" road connection to Harriet Hunt Lake. Roaded access may make this road corridor and lake viewshed even more sensitive to effects from future management activities.

Currently, this viewshed meets the adopted VQOs of Retention in the foreground and Partial Retention in the middleground.

Alternative 1 - No Action, and Alternative 5

The Existing Visual Condition (EVC) of this viewshed ranges from natural-appearing (Level II) on the slopes and ridge-tops, to slightly altered (Level III) on the lakes' north shoreline. Because this project proposes no visible harvest in any of these alternatives, the Future Visual Condition (FVC) would remain natural-appearing except for continuing change in tree height, color, and texture. Additionally, the road cut slopes would revegetate over time thereby reducing soil color contrasts with the adjacent forest.

Alternatives 2 and 7

Only one harvest unit is proposed (Unit 203) on the ridge-top south of the largest lake. This unit as proposed locates three patch cut openings in nearly unseen portions of the viewshed at the crest of the ridge. Due to this unit's placement on the ridge-top, exposed ground and slash would not be visible to the casual forest visitor. Unit 203 meets the adopted Retention VQO. The Future Visual Condition (FVC) would remain natural-appearing.

Middle Carroll Inlet Viewshed

This 12,045-acre priority saltwater use area viewshed is the first encountered in the Project Area while boating south from the State of Alaska's Swan Lake hydroelectric facility near the head of Carroll Inlet. It is located nearly 1 mile east of the Saddle Lakes Recreation Area Viewshed. The landscape character consists of a narrow canyon in the north, becoming a wider, more open canyon on the south near Island Point and Shoal Point. This canyon is 1/2 to 1 mile wide with steep slopes rising to 2,500-foot ridgecrests.

This viewshed has the most existing visible harvest (2,914 acres or 24 percent) of the Project Area. The eastern foreground and middleground slopes were extensively harvested in the 1970s to early 1990s. The western shore was harvested in the mid-1990s on very steep slopes in the foreground to near middleground. This harvest is fully exposed, directly facing any boating recreationist or other viewer. Because of these visual impacts, this viewshed's appearance ranges from moderately altered (Level IV) to heavily altered (Level V).

Because of the scale and intensity of visible harvest on the eastern middleground slopes, the EVC of this portion of the viewshed does not meet the adopted VQOs of Modification. The western portion of this viewshed meets the adopted VQO of Partial Retention in the foreground (owing to the height of second-growth forest) and the adopted VQOs of Modification and Maximum Modification on the middleground slopes (different land-use designations). The apparent scale of harvest is not dominant, so additional, small-scale alterations could still be made in this portion of the viewshed.

Alternative 1 - No Action

The EVC of this viewshed is moderately altered (Level IV) from an existing 2,914 seen acres of timber harvest and a LTF. Left unchanged, the FVC would remain the same except for a change in tree height, color, and texture.

Alternatives 2, 5, and 7

These three action alternatives propose from 3 to 12 harvest units (from 34 to 228 visible acres). This harvest would occur adjacent to existing alterations on middleground slopes more than 1 mile distant. Most of the proposed harvest units are screened from major impacts by the 1,000-foot shoreline vegetative buffer. Although there is an active LTF onshore immediately in the foreground at Shoal Cove, the proposed additional harvest would not add appreciably to visual contrasts. All proposed harvest in all alternatives would meet the adopted VQOs. However, visible foreground rock pits and road cut-and-fill slopes may not meet the VQOs. The FVC would remain the same except for a change in tree height, color, and texture.

The next two viewsheds are on separate waterways (and different priority use areas), are adjacent to each other, and share many of the same visible ground areas. Some viewed areas are seen as background distance zone, 4 or more miles from the viewer. Harvest, roads, or another management activity would, at a minimum, need to meet a Modification VQO, but should appear as a natural opening in the landscape setting.

Lower Carroll Inlet Viewshed

This 9,167-acre saltwater use area viewshed is primarily the eastern and western shorelines of Carroll Inlet from near Shoal Cove and Island Point to just south of Hume Island. The landscape character is less confined and more open with crossover views (to other priority routes and use area viewsheds). Visible areas are confined to the immediate foreground shoreline, occasional hummocks and knobs in the middleground, with moderately angled slopes and forested ridge-lines in the far middleground. It is interesting to note that many of the visible areas are actually fully within another viewshed (Upper and Lower Thorne Arm) or outside the Project Area, such as Misty Fiords National Monument, the mountains above Ketchikan, or on Annette Island many miles away.

Currently, this viewshed meets the adopted VQOs of Partial Retention in the foreground and Modification in the middleground.

Alternative 1 - No Action

The existing visual condition of this viewshed ranges from slightly altered (Level III) to moderately altered (Level IV) from an existing 1,593 seen acres of timber harvest. With no additional harvest, the FVC would remain the same except for natural changes in tree height, color, and texture.

Alternatives 2, 5 and 7

These three action alternatives propose from 10 to 21 harvest units (from 274 to 699 visible acres). Most of this harvest will occur adjacent to existing alterations on middleground slopes more than 1 mile distant. Units 240 and 241 (51 total acres), proposed only in Alternative 2, would be most visible to observers looking in a southwest direction from near the entrance of Shoal Cove. Because these two units are located immediately adjacent to the existing large expanse of private land harvest from this viewpoint, these units may not meet the VQO of Modification. Most of the other proposed harvest units in all the action alternatives are screened from view by beach fringe vegetation or would blend in with the already altered landscape. The FVC for all action alternatives, except for Alternative 2 noted above, would remain in a moderately altered (IV) condition.

Fish Creek Cabin and Anchorage Viewshed

Located at the head of Thorne Arm and adjacent to the mouth of Fish Creek, this priority recreation use area viewshed consists of two views from both a Forest Service cabin and a mooring buoy located about 100 yards offshore.

The 1,793-acre cabin viewshed is located at the back of a small cove at the outlet of Fish Creek which flows out of the Misty Fiords National Monument. Fish Creek is part of a Wild

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and Scenic Designated River (TLMP 1997) system. The short distance views are of an immediate foreground beach area and stream outlet, framed by heavy vegetated points of land. The long distance views frame mountainous terrain (clearly showing the effects of extensive previous timber harvest), at least 4 miles distant across the head of Thorne Arm.

The views from the mooring buoy are much more diversified since it is further out in the open saltwater bay. Here, the viewshed appears heavily (Level V) to drastically altered (Level VI) on the slopes and peaks to the southwest (nearly the same terrain viewed from the cabin site, but because of the wider angle of view exposing a wider water view, the scale of the visible landscape is much greater). Almost all the existing visible clearcuts within this viewshed become visible from the mooring buoy. Nearly all the visible harvest is located within lands designated as Timber Production LUD.

Alternative 1 - No Action and Alternative 5

The EVC as seen from the cabin ranges from slightly (Level III) to moderately altered (Level IV) from visible timber harvest. With no additional harvest, the FVC would remain the same except for natural changes in tree height, color, and texture.

Alternatives 2 and 7

From the cabin, Alternative 2 proposes Unit 168 with 7 scattered acres of patch clearcut and Unit 171 with 34 acres harvested by the Individual Tree Mark (ITM) partial harvest method. Alternative 7 proposes just one visible unit - Unit 168. Looking due south from the mooring buoy, in addition to the above units, portions of Units 113, 118, 119, and 120 (less than 67 total acres) may be visible in both Alternatives 2 and 7. From the mooring buoy vantage point, most of the proposed harvest units would not be noticeable due to the partial or alternative logging methods. There may be some visible evidence of roads and rock pits. However, these visible units and roads would meet the adopted VQO's of Modification and Maximum Modification. With this harvest, the FVC would change to an acceptable (TLMP) heavily altered visual condition level consistent with the desired future condition in the Forest Plan.

Upper Thorne Arm Viewshed

Located at the head of Thorne Arm (north of a line between Eve Point and Elf Point), this 6,620 acre viewshed encompasses many of the previous viewsheds' views but with many more vantage points. To the north, the slopes and ridges of the mountains above the other three viewsheds—Saddle Lakes, Middle Carroll Inlet, and Lower Carroll Inlet—can be seen from this saltwater use area. To the east, the mountains above Ketchikan and Mountain Point are visible as well. These mountains form a backdrop for the extensive private land timber harvest and clearly dominate the visual scene. To the west, the mountains within the Misty Fiords National Monument form a permanent scenic background.

Alternatives 1 and 5

No harvest is proposed under these alternatives. The EVC ranges from slightly altered (Level III) to moderately altered (Level IV) from past timber harvest. With no additional alterations from harvest activities, the FVC would remain the same except for natural changes in tree height, color, and texture.

Alternatives 2, 5 and 7

These action alternatives propose from 1 to 13 harvest units ranging from 14 acres in Alternative 5 to 373 acres in Alternative 2. As noted in the Fish Creek discussion, some units would be visible although their negative scenic effects would be mitigated by partial harvest methods (ITM and Shelterwood). Most of the proposed harvest units are screened from direct views of bare ground and logging slash. There may be some visible evidence of roads and rock pits. As proposed, all units and roads would meet the adopted TLMP VQOs.

Lower Thorne Arm Viewshed

This 4,980 acre saltwater use area viewshed is the first encountered when boating to the Project Area from either Ketchikan or Metlakatla. Its landscape character is of a narrow waterway bordered on both sides by steep mountains rising out of saltwater. Most of the southwestern and western portion of the viewshed is restricted from timber harvest by the Old-growth LUD. To the northeast and east, the land areas are located in the Timber Production LUD, which allows for a higher level of visible harvest. Just 477 acres of existing harvest are visible within this viewshed.

Alternatives 1 and 5

No harvest is proposed in the no-action alternative and Alternative 5. The EVC as seen from the waterway ranges from slightly altered (Level III) to moderately altered (Level IV) from visible timber harvest and roads. With no additional harvest, the FVC would remain the same except for natural changes in tree height, color, and texture.

Alternatives 2 and 7

Each of these two action alternatives propose four harvest units in this viewshed ranging from 73 acres in Alternative 7 to 113 acres in Alternative 2. As noted in the Fish Creek and Upper Thorne Arm viewshed discussions, some units would be visible, although their negative scenic effects would be mitigated by partial harvest methods (ITM and Shelterwood). Most of the proposed harvest units are screened from direct views of bare ground and logging slash. There may be some visible evidence of roads and rock pits. As proposed, all units and roads would meet the adopted TLMP VQOs.

Cumulative Effects

While individual harvest units may meet the adopted VQOs, when viewed as a group along with previous harvest, they may disturb too much of the natural landscape during one period of time. This could create a significant cumulative effect.

The Cumulative Visual Disturbance (CVD) is a way of determining the level of visual impacts over broader areas by evaluating the percentage of harvested area visible in larger viewsheds. It is a threshold or amount of visible disturbance (such as timber harvest) allowed in any given area in order to meet the intent of the Visual Quality Objective (VQO) for that area. This threshold, or CVD level, ranges from 8 to 35 percent of the area that may be in a disturbed visual condition at any one time. If a disturbed area is over the prescribed threshold, the CVD guideline is exceeded. The CVD threshold levels for the Sea Level Project Area VQOs are stated in the following text.

- Retention VQO - No more than 8 percent of an area may be in a disturbed condition at any one time.
- Partial Retention VQO - No more than 15 percent of an area may be in a disturbed condition at any one time.
- Modification VQO - No more than 25 percent of an area may be in a disturbed condition at any one time.
- Maximum Modification VQO - No more than 35 percent of an area may be in a disturbed condition at any one time.

An evaluation of the CVD for the Sea Level Project Area shows that no VCU or combination of project area viewsheds exceed the CVD guidelines under the VQO scenario established by the 1997 TLMP.

Alternative 2, which harvests the maximum amount of timber allowed under Forest Plan Standards and Guidelines, is used to project the level of harvest through the end of the rotation. It is assumed that reduced levels of harvest, as part of another alternative, will be harvested in a future entry.

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Assuming a continuation of the present harvest level and implementation of Forest Plan resource constraints, timber harvest would continue to occur in the Sea Level Project Area. Over time, as further entries occur, the distribution of additional harvest units would add to visual diversity, thereby increasing the capacity of a viewshed's ability to absorb future alterations. During this time, the forest would become a mosaic of varying sizes, shapes, heights, and textures reflecting those alterations. This mosaic would achieve the desired future condition of the Forest Plan.

Visual Impacts and Forest Regeneration

The potential for visual impact is greatest right after timber is harvested; stumps and debris, fresh road cuts and fills, and exposed boles and limbs of adjacent stands dominate the visual setting. By the 5th year of regeneration, the new forest is filling out, and low-lying vegetation, young alder and conifer trees begin to cover the stumps and exposed ground. From year 5 to 20, the young trees have become established, reaching a height of approximately 15 feet. After 20 years, the forest visitor would see a stand of spruce and hemlock, with some Alaska yellowcedar in the foreground. In the middle-ground, the contrast between the new forest and mature forest would be very obvious.

At the end of 50 years, the new forest would reach a height of approximately 50 feet. The canopy would be closing and the new forest would appear very dense. Toward the end of 80 years, the stand would reach 75 percent of its mature height. The canopy would appear full with crowns touching, allowing little sunlight to reach the forest floor and little understory vegetation. At 100 years, little visual difference would be noticed between the 100-year forest and an adjacent mature forest. Timber would reach approximately 100 feet in height and appear as a healthy and full canopy.

Silviculture and Timber

Key Terms

Commercial Forest Land (CFL)—land that is capable of producing continuous crops of timber (20 cubic feet of tree growth annually, or at least 8 MBF).

Diameter at Breast Height (DBH)—the diameter of a tree, in inches, 4½ feet above the root collar on the uphill side.

Desired future condition or goal—a concise statement that describes a desired future condition normally expressed in broad, general terms that are timeless, in that there is no specific date by which the goal is to be achieved (36 CFR 219.3).

Duff layer—vegetative material covering the mineral soils in forests, including the fresh litter and well-decomposed organic material and humus.

Even-aged—a stand in which trees of essentially the same age grow together.

Managed stand—a stand of trees in which stocking-level control is applied to achieve a desired condition.

MBF—thousand board feet.

Logging System Transportation Analysis Plan (LSTA)—interdisciplinary design and mapping of all potential timber-harvest units, including associated logging and transportation systems, within a Project Area.

Midmarket analysis—the value and product mix represented at the quarter in which the pond-log value (end-product selling price less manufacturing cost) for the species and product mix most closely matches the point between the ranked quarters of the Alaska Index Operation pond-log value, adjusted to Common Year Dollars, where one half of the harvest of timber from the Tongass National Forest has been removed at higher values and one half of the timber has been removed at lower values, during the period from 1979 to the current quarter (FSH 2409.22 R10 Chapter 531.1-2).

MMBF—million board feet.

Partial cut—method of harvesting trees where any number of live trees are left standing in any of various spatial patterns; not clearcutting.

Selling Value—summation of stumpage, production costs (stump to truck costs), manufacturing costs (value-added costs), and profit and risk costs of an end product.

Two-aged Clearcutting with reserves— a clearcutting method in which varying numbers of the reserve trees are not harvested to attain goals other than regeneration.

Two-aged Shelterwood with reserves— a variant of the shelterwood method in which some or all of the shelter trees are retained, well beyond the normal period of retention, to attain goals other than regeneration.

Uneven-aged System—method of regeneration stand to maintain a range of age classes and structure.

Windfirm trees—trees that have been exposed to the wind throughout their life and have developed a strong root system, or trees that are protected from the wind by terrain features.

Windthrow—the act of trees being uprooted by the wind. Three types of windthrow include: (1) endemic, when individual trees are blown over, (2) catastrophic, when a major windstorm can destroy hundreds of acres, and (3) management related, when the clearing of trees in an area make the adjacent standing trees vulnerable to windthrow.

Silviculture: Affected Environment

Introduction

Ecosystem management is a new term that emphasizes an old concept of management by objectives with due consideration for biological, physical, and ecological factors. The two principal points are: (1) management of the Forest resources must consider a full range of resource objectives, not only commodity outputs, and (2) management must be practical and achievable. The physical and biological limitations serve to restrict the range of treatments and objectives that can be achieved on a particular site. Choices are based on matching the attributes of the silvicultural systems with specific management objectives and the ecological characteristics of specific stands.

Silviculture can be defined as the theory and practice of manipulating forest vegetation; that is, controlling the establishment, composition, and growth to meet various resource objectives in a manner that is biologically, ecologically, and environmentally sound, cost effective, and socially and politically acceptable. Management objectives may include aesthetics, water quality, fisheries, timber, wildlife, or recreation. Wood production may or may not be a primary objective of silvicultural systems.

Silvicultural systems are used to manage forest stands. A stand is a forest community possessing sufficient uniformity in composition, age, spatial arrangement or condition, to be distinguishable and capable of being delineated from adjacent communities. A silvicultural system is a program of treatments applied throughout the life of the stand; it is the process by which the stand is manipulated for a specific purpose and it is the means of reaching a desired future condition. This process may include harvest or regeneration of the stand, intermediate cuttings, or other cultural treatments necessary for the replacement and development of the forest stand. No single silvicultural system can produce all desired combinations of products and amenities from a particular stand or project area. Silvicultural systems are applied through prescriptions, which are written records of the examination, diagnosis, and treatment regimes prescribed for the stand. Prescriptions are prepared and written by a certified silviculturist.

Forested Plant Communities

The natural vegetation of the Sea Level Project Area is a mosaic of coniferous forest, alpine tundra, muskeg (bog), shrubland, and estuarine and beach-fringe plant communities. Using the *Tongass Forest Plant Association Management Guide* (DeMeo 1992), the Project Area has been classified into forested plant associations which are based upon the climax-plant community. The climax-plant community is the result of the interaction between landform, climate, and soils. All forested plant associations having the same climax tree(s) are referred to as a series and are named for the climax tree(s). The Sea Level Project Area has seven plant series. These series are displayed by value comparison unit (VCU) in Table Silviculture-1, and are described below.

Sitka Spruce Series

Plants in this series are generally associated with riparian areas and disturbed sites (e.g. stringers between avalanche chutes). This series can also occur in combination with mountain hemlock at higher elevations. Sitka spruce is the dominant overstory-tree species but western hemlock can be co-dominant. Red alder may also be present. Common shrub species include devil's club, blueberry, and salmonberry. Ferns and skunk cabbage are the prevalent herbs. The Sitka spruce series is generally highly productive, and the heights of mature spruce often exceed 150 feet.

Western Hemlock-Western Redcedar Series

This series represents a transition from the less productive, poorly drained, mixed conifer series, to the more productive, better drained western hemlock series. Site productivity is

typically low to moderate. It occurs on a wide variety of landforms, but is most characteristic of rolling hill country and lower hill- and mountain-slopes. Near the northern limit of its range on the Project Area, redcedar growth is limited by light and temperature. Consequently, while it may be found up to 1,000 feet above sea level, it is most common below 500 feet.

The overstory is dominated by western hemlock. Redcedar commonly occupies 10 to 25 percent of the forest canopy. Yellowcedar may also occur. Other species are incidental. The understory is characterized by blueberry, although salal may be locally common on warmer sites below 500 feet in elevation.

Western Hemlock-Yellowcedar Series

This series can be considered a subset of the western hemlock series on the Ketchikan Administrative Area. It is most common on mountains and hillslopes around 1,000 feet elevation, but can be found from sea level to the subalpine zone. Dominant overstory tree species are western hemlock and yellowcedar; western redcedar may also be present. Blueberry is the dominant shrub, with rusty menziesia being common. Dominant herbs vary and include ferns, bunchberry, dogwood, skunk cabbage, and five-leaf bramble. Site productivity is best described as moderate.

Western Hemlock Series

Plant associations in this series generally occur in the uplands on mountain-, hill-, and foot-slopes with moderate to well-drained soils. The predominate overstory tree species is the western hemlock, but Sitka spruce occurs in the overstory in relation to the frequency of disturbance. The shrub layer is dominated by blueberry and rusty menziesia; devil's club, however, can be a major component in some areas. Bunchberry and five-leaf bramble dominate the herb layer, but skunk cabbage can be a major component in areas with poorly-drained soils. Plant productivity is generally high, with mature hemlock often exceeding heights of 125 feet.

Most sites harvested to date on the Project Area have been of the Western Hemlock Series.

Mountain Hemlock Series

These plant associations are generally found on cold, high-elevation sites above the western hemlock series. Mountain hemlock is the dominant overstory tree species, with Sitka spruce and yellowcedar occurring to a lesser degree. The shrub layer is dominated by blueberry. As the treeless alpine zone is approached, copperbrush and cassiope become more common. Deer cabbage is a common herb. Plant productivity is limited by the shorter growing season at high elevations and by reduced soil drainage common to some of these associations.

Mixed Conifer Series

Mixed conifer associations occupy sites which have limited productivity due to poor soil drainage or shallow soil, or both. These plant associations generally occur in the uplands, often near muskegs. Dominant overstory tree species are mountain hemlock, western hemlock, western redcedar, and yellowcedar. Sitka spruce and shore pine can also occur. Blueberry and rusty menziesia are the dominant shrub species. Prevalent herbs vary and include skunk cabbage, five-leaf bramble, deer cabbage, and ferns.

Shore Pine Series

This group of associations is on the transition line from mixed conifer to nonforest muskeg. Soils are poorly drained and productivity is very low. Understory vegetation, because of the abundant light available, is very diverse. Muskeg plants such as Labrador tea, crowberry, bog kalmia, bog blueberry, and sedges are common. Salal may occur on some sites.

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Table Silviculture and Timber-1 displays the approximate percent of area occupied by each forested plant series found in the Project Area.

Table Silviculture and Timber-1
Percent of Forested Plant Communities (by VCU and Plant Series)

VCU	Sitka Spruce	Western Hemlock	Mountain Hemlock	Shore Pine & Mixed Conifer	Western Hemlock-Alaska Cedar	Western Hemlock-Western Redcedar	Total Forested Land
746	1.88	43.92	12.09	25.94	6.52	4.96	95.31
753	1.18	26.31	4.37	26.31	2.99	25.65	86.81
754	3.72	67.49	0.00	25.08	0.00	2.17	98.46
755	0.53	34.86	0.00	28.11	4.62	20.25	88.37
756	0.85	47.87	0.01	37.74	0.00	9.73	96.20
757	1.24	8.39	2.99	22.77	9.71	41.61	86.71
759	2.61	2.27	7.58	25.90	4.73	44.13	87.22

Source: Trulock 1997.

Note: This information derived from Ketchikan Area GIS, CLU data layer.

Nonforested Plant Communities

Various nonforest plant communities occur in estuaries, riparian areas, muskegs, alpine meadows, and alpine-lichen-rock outcrops in the Project Area. Additional information on nonforested communities can be found in the Ecological Landtypes section of this chapter.

Silvicultural Systems

Silvicultural systems are named for the method of regeneration cutting by which the stand is replaced. These regeneration cuttings are: selection (single tree and group), seed-tree, shelterwood, and clearcut. They can be grouped into even-aged and uneven-aged systems, depending on the age structure that is created.

Even-aged Systems

Even-aged systems produce stands that consist of trees of the same or nearly the same age. A stand is considered even-aged if the range in tree ages normally does not exceed 20 percent of the rotation age—the age at which the stand is harvested. Clearcutting, seed-tree cutting, and shelterwood cutting will produce even-aged stands. Even-aged stands have a beginning and an end point in time. Even-aged systems produce distinct successional stages and there are even-aged stands of various ages and sizes distributed throughout the managed forest. Therefore, even-aged forests have relatively low vertical diversity, but have a high degree of horizontal diversity; the forest is a mosaic of canopy and openings. The low vertical diversity is a result of the comparatively simple structure of the even-aged stand.

Clearcutting Method

This method involves the removal of the entire stand in one cutting and, reproduction is obtained by natural seeding from adjacent stands or artificially. In the narrowest sense, the cutting operation includes all standing woody vegetation. A variant of this method includes felling only merchantable trees, and with careful harvest technique, retains the existing advance regeneration. This method mimics large-scale natural disturbances such as wildfire or windstorms. The primary objective of this method is to reestablish an even-aged stand by

removing the mature one. Decisions to clearcut are usually based on a number of factors such as insect epidemics, disease, fire, decadent stand conditions, desire to change species, desire to introduce genetically superior trees, or desire to regulate volume production.

The clearcutting method with natural regeneration is historically the most commonly used system on the Tongass National Forest. The system works well, but natural regeneration is usually too abundant. The regeneration is derived partly from wind-dispersed seed and partly from advance reproduction that survived the logging operation.

Silvicultural advantages of the clearcutting method can be listed as follows: (1) it permits longer cable yarding distances than would be practical in partial cutting, allowing for fewer roads, reduced road costs, and less soil disturbance due to road construction, (2) exposure to the sun raises soil temperatures, which speeds decomposition of the organic forest floor, thereby improving the productivity of the forest site, (3) favors regeneration of Sitka spruce by destroying advance hemlock regeneration (reduces competitive advantage of the hemlock) and disturbing the forest floor, creating seed beds that are more favorable for reproduction of spruce, (4) eliminates residual overstory trees infected with the parasitic plant, dwarf mistletoe (preventing infection of western hemlock in the new stand), (5) eliminates the risk of windthrow in residual stands (stands left within the cutting boundary, as with seed-tree or shelterwood), (6) no logging damage to adjacent standing timber, and (7) logging costs are lower than with other methods.

Silvicultural disadvantages of clearcutting are: (1) seedling distribution is uneven and parts of an area may become understocked or overstocked, (2) species control is poor, (3) the chance of windthrow along cutting boundaries is increased, (but can be reduced through proper design of cutting units), (4) soil is more susceptible to erosion, landslides, and rapid runoff of water, (5) is aesthetically the least desirable method, because of the heavily altered appearance of recently harvested areas, and (6) unmerchantable trees may have to be cut.

Currently, the Project Area contains 12,164 acres of seedlings and saplings. Seedlings and saplings are trees less than or equal to 4.9 DBH. There are 56 acres of pole timber and young sawtimber (5 inches to 9 inches DBH) sized stands. Nearly all of these sites were previously harvested using the clearcut silvicultural method.



Landscape view of clearcuts and clearcuts with reserves.

Two-Aged Systems

Two-aged systems produce stands that contain two age classes for most of the rotation. The resulting stand may be two-aged or trend towards an uneven-aged conditions as a consequence of both an extended period of regeneration establishment and the retention of reserve trees that may represent one or more age classes. The overwood trees provide structural diversity and a biological legacy.

Clearcutting with Reserves

Clearcutting with Reserves is a clearcutting method in which varying numbers of reserve trees are not harvested to attain goals other than regeneration.

Seed Tree with Reserves

Seed Tree with Reserves is a seed tree method in which some or all of the seed trees are retained after regeneration has become established to attain goals other than regeneration.

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Shelterwood with Reserves

Shelterwood with Reserves is a variant of the shelterwood method in which some or all of the shelter trees are retained, well beyond the normal period of retention, to attain goals other than regeneration.

Some advantages of two-aged systems are:

- Two-aged management regimes can produce stands of greater structural diversity. The structural diversity comes from the retention of green trees and/or snags.
- Green tree retention provides carryover structural components, which could allow old-growth characteristics and structural attributes to redevelop in a shorter time. The method would be suitable where windthrow or mistletoe is not a major problem and the terrain is suitable to logging.
- This method could provide much of the structural complexity of classic uneven-aged systems while reducing the associated operational difficulties (Long and Roberts, 1992); refer to following discussion on uneven-aged management.
- This method retains some of the advantages of even-aged systems while attaining some of the features of uneven-aged systems.
- Some disadvantages of two-aged systems are:
 - This method can result in an immediate reduction in yield (trees left on site), and there may be a long-term reduction in growth and yield. Work on green tree retention techniques by Long and Roberts (1992) in mixed-conifer stands in Northern Idaho indicates that there may be a 20 percent reduction in yield (one rotation) and an increase in harvest costs due to the smaller average tree sizes. Smaller tree sizes reduce value and increase handling costs. Work done by Birch and Johnson (1992) in coastal Douglas-fir found a 6 to 25 percent (multiple rotations) decline in growth in future stands depending on the number of trees left, their size, and rotation age of future stands. They also found an increase in harvest costs of 5 to 10 percent and a decline in present net value in existing and future stands. (TLMP, 1997)
- The disadvantages of the shelterwood system would also apply to the irregular shelterwood system.
- Because of the increased complexity, there is a greater degree of risk in logging (i.e., safety issues).

Uneven-Aged Systems

Uneven-aged systems create stands that include three or more distinctly different age classes, with no beginning or end point in time. Uneven-aged systems produce stands of high structural diversity because of the intermingling of the different age classes. Regulation of the forest is based on development and maintenance of a range of tree diameters, with many trees in the smaller diameter classes and progressively fewer in the larger diameter classes. These forests have a high degree of vertical diversity, but horizontal diversity will be low. The system produces large blocks of continuous forest cover dominated by relatively mature trees; there is a gradual reduction of shade-intolerant trees and understory plants. This system has not been formally tested on a longterm basis in the hemlock-spruce type of Southeast Alaska.

Regulation of even-aged management is based on the area and time required to grow trees to a merchantable size. Regulation of uneven-aged stands requires the establishment of: (1)

maximum tree diameter, (2) residual stocking levels or volume required to maintain growth and yield, and (3) the desired structure, which controls the diameter distribution.

Individual-Tree Selection Method

With the individual-tree-selection method, trees are removed individually, by prescription, from a large area in an overall random pattern. This method simulates natural disturbances caused by the death of scattered trees. Regeneration occurs under the partial shade of larger trees, and seedlings must be able to grow in a shaded environment. Sitka spruce and western hemlock are adapted to grow in a shaded environment. Under this selection method, the stand always has some relatively old trees. Some of the cuttings may be intermediate in timing in immature age classes. Each tree is evaluated for its contribution to the desired characteristics of the stand.

Silvicultural advantages of the individual-tree selection are: (1) it is capable of maintaining an uneven-aged stand, (2) reproduction of tolerant species is easily obtained, (3) seedbed-site protection is excellent with little or no exposure to insolation (exposure to sunlight) and wind, (4) stands can be readily adapted to changing market conditions, and (5) it usually has the highest aesthetic rating.

Silvicultural disadvantages of the single-tree selection method are: (1) highly skilled people are needed to practice it, (2) logging costs are much higher because of the small volume per acre, the frequent entries to each stand required, the complexity of the logging systems, the care necessary to hold damage to an acceptable limit, and wide distribution crop trees, (3) a more extensive road system needs to be constructed and maintained to secure the same volume of timber as obtained by use of other systems, (4) it would not be suitable for hemlock stands infected with dwarf mistletoe, (5) frequent, light entries can result in accelerated stand deterioration as the stand is opened up to wind, and damage can be done to boles and roots of residual trees from felling and yarding tall, large-diameter, defective trees, and (6) shade-tolerant western hemlock would eventually replace spruce and cedar species within the stand.

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Figure Silviculture and Timber-1
Before and After an Individual-Tree Selection.



Group-Selection Method

With the group-selection method trees are harvested in small groups (usually less than 2 acres). The openings created in the stand resemble miniature clearcuts and the uneven-aged stand is composed of a mosaic of even-aged groups; the small openings simulate small natural disturbances.

Silvicultural advantages of the group-selection method are: (1) the regeneration in the small groups grows under even-aged conditions and better stem form is obtained, (2) harvesting is more concentrated so logging costs are lower than individual tree, (3) harvesting in groups lowers damage to the residual stand, (4) it tends to increase diversity of plants and animals because of a temporary increase in shade-intolerant plants in the small openings, (5) intermediate cuts may be made less frequently without sacrificing diameter-class distribution although composition may be affected, (6) the small groups may be aesthetically more acceptable to some people, and (7) the small openings would be more favorable for spruce and cedar regeneration.

Silvicultural disadvantages of the group selection method are the same as the individual-tree method but to a lesser degree. The major limitations are the operational difficulties in the steep, rugged topography found in the Project Area.

The American marten Standards and Guidelines set forth in the TLMP 1997 are extremely prescriptive (for more information please see TLMP 1997 for the actual Standards and Guidelines and the Tongass National Forest Land and Resource Management Plan Implementation Policy Clarification, August 1998).

Legacy Structure Prescription

If less than 33 percent of the VCU has been previously harvested and openings greater than 2 acres will be created in high-value-marten habitat, silvicultural systems used must maintain on average the following structural characteristics:

- 10 to 20 percent of original stand structure,
- four large trees per acre which are 20 to 30 inches in DBH,
- three decadent standing trees per acre which are 20 to 30 inches in DBH, and
- retained trees should have a reasonable assurance of windfirmness and clumping should be used whenever it provides obvious benefits.

Variable Structure Prescription

In VCUs where over 33 percent has been previously harvested and openings greater than 2 acres will be created in high-value-marten habitat, the silvicultural systems used must maintain the following structural characteristics on average:

- 30 percent canopy closure evenly distributed, however clumping may occur,
- eight large trees per acre which are 20 to 30 inches in DBH,
- three decadent standing trees per acre which are 20 to 30 inches in DBH,
- three down pieces per acre which are 20 to 30 inches in DBH, and
- retained trees should have a reasonable assurance of windfirmness; clumping is acceptable in certain circumstances.

A site-specific silvicultural prescription that incorporates these concepts will be prepared in coordination with a wildlife biologist prior to implementation.

Management Objectives for American Marten

Selection of Harvest-Cutting Method

Criteria

Criteria for the selection of harvest-cutting methods to be used on National Forests in Alaska are provided in 36 Code of Federal Regulations (CFR) 219.27(b) and the Alaska Regional Guide (USDA November 1983). The selected method must meet all of these criteria:

1. capable of meeting special management and multiple-use objectives (36 CFR: Criteria 1 and 6, Regional Guide: Standard 2),
2. permit control of vegetation to establish desired species composition, density, and rates of growth (36 CFR: Criteria 4 and 6),
3. promote a stand structure and species composition which minimizes risks from solar radiation, disease, and windthrow (36 CFR: Criterion 4, Regional Guide: Standard 2),
4. use available and acceptable logging methods (36 CFR: Criterion 4, Regional Guide: Standard 2),
5. assure that lands can be adequately restocked (36 CFR: Criterion 2),
6. be practical and economical in terms of transportation, harvesting, preparation, and administration of timber sales (36 CFR: Criterion 7, Regional Guide: Standard 2),
7. not be selected solely on the basis of greatest dollar return or highest output of timber (36 CFR: Criteria 3 and 5), and
8. not permanently reduce site productivity or impair conservation of water and soil resources (36 CFR: Criteria 3 and 5).

In addition to the applicable laws and regulations, on June 4, 1992 the Chief of the Forest Service issued National direction on reduced use of clearcutting. Clearcutting would be limited to areas where it is essential to meet Forest Plan objectives such as the following:

1. to establish, enhance, or maintain habitat for threatened, endangered, or sensitive species,
2. to enhance wildlife habitat or water-yield values,
3. to provide for recreation, scenic vistas, utility lines, road corridors, facility sites, reservoirs, or similar developments,
4. to rehabilitate lands adversely impacted by events such as fires, windstorms, or insect or disease infestations,
5. to preclude or minimize the occurrence of potentially adverse impacts of insect or disease infestations, windthrow, logging damage, or other factors affecting forest health,
6. to provide for the establishment and growth of desired trees or vegetative species that are shade intolerant,
7. to rehabilitate poorly stocked stands due to past management practices or natural events, and
8. to meet research needs.

Factors Influencing the Choice of Silvicultural Systems

The choice of silvicultural systems will depend on the silvical characteristics—that is, the reproductive habits and growth requirements—of the tree species, the operational environment (physical and biological setting), the management objectives that are to be achieved, and the operational feasibility of logging systems (e.g., highlead, skyline, tractor, helicopter, etc.).

Silvical Characteristics - Commercial Species

Sitka Spruce

Sitka spruce (*Picea sitchensis*) is the largest and one of the most valuable trees, both biologically and economically. This species is classified as intermediate in tolerance ("tolerance" is defined as the ability to grow and prosper in the understory; light, moisture, or other environmental variables may be the limiting factor) and demands more light than its associate western hemlock (Harris and Farr 1974). Sitka spruce is a prolific seed producer. It produces small seed that can be carried long distances. Sitka spruce seed will germinate on almost any kind of seedbed if moisture is abundant. Natural regeneration can, consequently, be obtained through various reproduction methods. Establishment is best on mineral soil with organic matter and with side shade and overhead light. Spruce has an advantage over hemlock on bare soil. The percentage of spruce reproduction often can be increased by clearcutting and exposing more mineral soil during the logging operation. The rooting characteristics of Sitka spruce show great variability, but in Southeast Alaska, the species tends to be shallow rooted. Consequently, the species is vulnerable to compaction and windthrow. The bark is relatively thin which makes it susceptible to logging injury and subsequent decay. Windthrow is the most serious damaging agent to Sitka spruce.

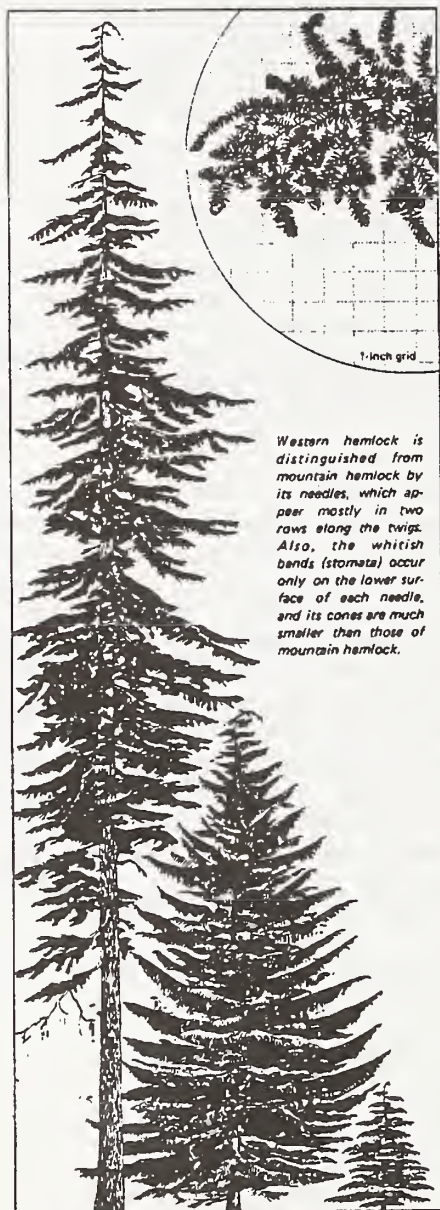
Western Hemlock

Western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) is also a major component of the Tongass National Forest. Western hemlock is classified as very tolerant and dominates the reproduction in old-growth forests. This makes it an ideal species for management that includes partial cutting. Other associated conifers include Sitka spruce, western redcedar, Alaska yellowcedar, lodgepole pine, Pacific silver fir, subalpine fir, and mountain hemlock. Western hemlock is a prolific seed producer. It produces seed almost every year, with heavy crops every 5 to 8 years. The seed is small and can be carried long distances in strong winds. The species can thrive on a wide variety of seedbeds; consequently, natural reproduction can be obtained through various methods from individual-tree harvest to clearcutting. Through careful logging most stands are often adequately stocked or overstocked from advanced regeneration. Hemlock does not develop a taproot and is a shallow-rooted species, thus is susceptible to windthrow. Most of the roots, particularly the fine roots, are near the surface and are susceptible to damage from compaction. Like spruce, this species also has thin bark and is susceptible to logging injury and subsequent decay. Hemlock dwarf mistletoe is a common disease and is usually best controlled by clearcutting.

Figure Silviculture and Timber-2 illustrates characteristics of the western hemlock and Sitka spruce.

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Figure Silviculture and Timber-2
Characteristics of the Western Hemlock and Sitka Spruce



WESTERN HEMLOCK

Tsuga heterophylla



SITKA SPRUCE

Picea sitchensis

Western Redcedar

Western redcedar (*Thuja plicata* (Donn)) is an important tree species both economically and from a cultural perspective. Because of its straight grain, size, light weight, and workable texture, Southeast Alaska Natives use this species for totem poles, clan houses, canoes, etc. The stringy bark is used for making mats, baskets, and ropes. Western redcedar is commonly found in association with Alaska yellowcedar, western hemlock, lodgepole pine, and Sitka spruce.

Western redcedar is less tolerant than western hemlock and Sitka spruce. Western redcedar is near the northern edge of its range in the Project Area and is typically found on poorly drained organic soils. The best growth is achieved on better sites, where it forms a minor component of a stand where hemlock and spruce dominate. Western redcedar is a prodigious seed producer, but because of the small surface area of the seed wing, the seed does not travel far from the source. The best germination occurs on sites that have exposed mineral soil and full light which warms the soil. Although the germination percentage is often quite good, the seedling mortality rates are usually quite high, particularly when exposed to full light. Like most cedars, the tree is long lived and highly resistant to insect and disease attacks. The shallow water table in most organic soils makes western redcedar susceptible to windthrow. It is considered less windfirm than either spruce or hemlock and is used only as a last resort for tailholds or guyline anchors.

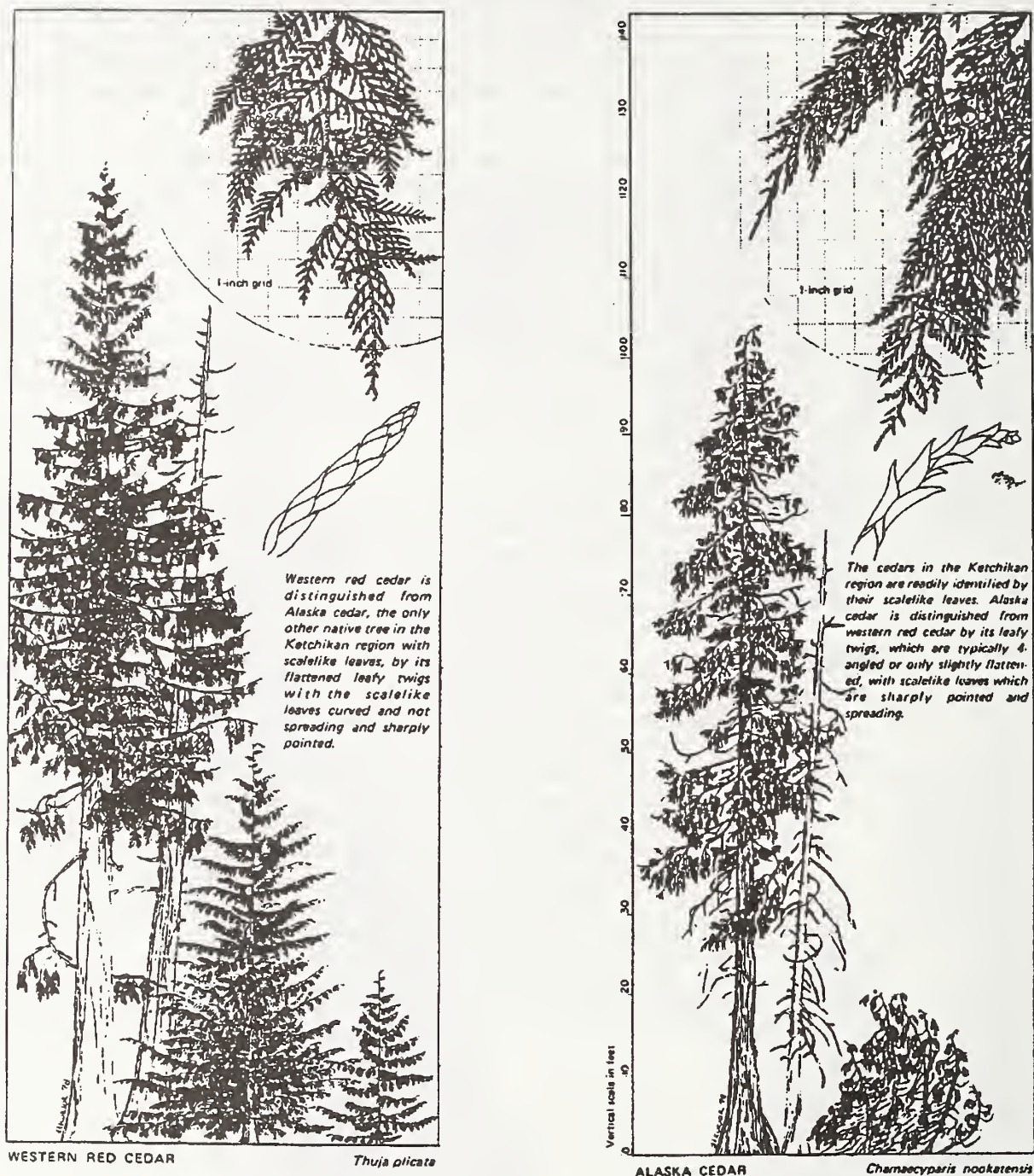
Alaska Yellowcedar

Alaska yellowcedar (*Chamaecyparis nootkatensis* (D. Don, Spach)) is a minor, but valuable, commercial tree species found within the Project Area. At lower elevations it is commonly found on poorly drained organic soils in association with western redcedar, western hemlock, lodgepole pine, and Sitka spruce. At elevations above 1,000 to 1,500 feet western redcedar is no longer a stand component and mountain hemlock replaces western hemlock. At elevations above 1,200 to 1,500 feet Alaska yellowcedar may only be of firewood quality.

Good cone crops are irregular, occurring only 1 out of every 4 to 7 years. The seed is heavy and will disperse 132 to 264 feet (2 to 4 chains). The upper third of the crown is the most productive for cone production and seed viability. Alaska yellowcedar is classified as an intolerant species like western redcedar and, as such, is less shade tolerant than hemlock or spruce. Alaska yellowcedar is especially susceptible to winter drying where warm, sunny weather, in combination with frozen soils, causes top kill. Warm weather in the winter of 1956 resulted in extensive top kill that is still evident today. Yellowcedar decline is another problem (possibly the same as winter drying) that is resulting in dead tops and mortality. Alaska yellowcedar is not particularly windfirm, but trees with dead tops provide much less resistance to the wind and may therefore be quite windfirm. The harvesting of old-growth-cedar forests through large clearcuts has resulted in regeneration to other species. Whether this is due to the periodicity of the seed crops, the heavy seed with limited dispersal distance, cedar decline, or some other cause is not known. Some form of partial cutting which favors yellowcedar or artificial regeneration may be needed to ensure its continued presence.

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Figure Silviculture and Timber-3
Characteristics of the Western Redcedar and Alaska Yellowcedar



Pacific Silver Fir

Pacific silver fir (*Abies amabilis*) is a medium-sized resinous and aromatic tree, found occasionally in small pockets in extreme Southeast Alaska. This tree is found infrequently within the Project Area and is considered to have wood properties very similar to hemlock.

Shore Pine

Shore pine (*Pinus contorta*) is known also as lodgepole pine, bull pine, and by various other common names. This is the common pine throughout Southeast Alaska, and is often low spreading and scrubby. This species has cultural value as a Christmas tree and for use of the boughs for ornamental purposes.

Silvical Characteristics—Noncommercial Species

Pacific Yew

Pacific yew (*Taxus brevifolia nutt.*) is a small tree or shrub that has been found in the Project Area; scattered trees have been located throughout the southern portion of Revillagigedo (Revilla) Island (T. Demeo, USDA FS, Ketchikan Area Ecologist, personal communication 1992). Pacific yew is at the very northernmost portion of its range. It is typically found within 500 feet of saltwater as it depends upon the warm maritime climate to exist at this latitude. The bark from Pacific yew is high in taxol, which has been shown to have medicinal value for the treatment of cancer.

Alder

Alder (*Alnus species*), both red and Sitka alder, are found throughout the Project Area. Sitka alder tends to be shrublike in form, with multiple stems, and rarely exceeds 30 feet in height. In contrast, red alder usually has a single, well-defined stem and can reach heights of up to 50 feet in the Project Area. Alder is commonly found along beaches and streams, and on avalanche tracks and landslide chutes. Alder is also common on roadsides, landings, and wherever soil has been highly disturbed. Alder is a primary-succession species (one of the first to recolonize highly disturbed sites) and is usually shaded out 40 to 50 years after first being overtopped by Sitka spruce. Red alder is rarely found above 1,000 feet in elevation, but Sitka alder may grow up to and above 2,500 feet in the Project Area. Alder seed is extremely light and can be spread great distances by the wind. A mineral soil seedbed is required and both species of alder are extremely shade intolerant. During its maximum growing period, alder can achieve 5 feet of height per year. The roots of both species fix atmospheric nitrogen. Because of this ability to fix nitrogen, and because of abundant leaf fall which adds needed humus, alder is important for stabilizing or improving disturbed forest soils. Red alder is used for smoking fish and for carving, and is currently being researched for its viability as a commercial product in the Ketchikan area. Sitka alder currently is not used commercially.

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Operational Environment

Climate

The forest has a maritime climate with abundant moisture throughout the year and has relatively mild winter temperatures and cool summers. Lack of a pronounced drought is probably the most important factor in affecting vegetation. The combination of warm water from the Japanese currents and prevailing westerly onshore winds result in mild, humid conditions throughout the Project Area. The weather patterns of Southeast Alaska develop strong winds and winter storms tend to be very intense. The strong winds are usually accompanied by rainfall which saturates soils, contributing to windthrow.

Table Silviculture and Timber-2 displays the number of days, by month, when gale-force winds (over 30 miles per hour) occurred between 1953 and 1978 according to the National Oceanographic and Atmospheric Administration Meteorological Station at Annette Island, Alaska.

Table Silviculture and Timber-2
Number of Days, by Month, with Winds Over 30 Miles Per Hour

Month	Miles Per Hour						Total Days
	31-35	36-40	41-45	46-50	51-55	56-60	
July	3						3
August	5	4					9
September	11	7	3		1		22
October	67	45	13	4	3		132
November	58	41	5	8	1		113
December	64	39	9	9	2	3	126
January	70	29	5	6	2	2	114
February	60	31	2	8			101
March	25	9	8	4			46
April	32	9	7	2			50
May	8	5	2				15
June	11	1	1				13
Total	414	220	55	41	9	5	744

Source: Wind in the Forests of Southeast Alaska and Guides for Reducing Damage, A. S. Harris, PNW-GTR-244.

Over 80 percent of the gale-force winds reported between the years 1953 and 1978 were from the south or southeast. They occur during the fall and winter months when heavy rains have saturated the soils; however, gale-force winds occur during every month of the year and come from primarily the southeast.

The rooting habits of western hemlock and Sitka spruce make these species susceptible to windthrow; both species are shallow rooted and depend on support from surrounding trees for

wind resistance. Both species are susceptible to stem and root rots which make them more vulnerable to wind damage. Wind is a major disturbance factor in Southeast Alaska, altering the structure of the forest. Scattered windthrow of large, overmature trees is a prime cause of mortality and creates small openings in which the advanced growth in the understory may develop (group selection would mimic this effect). Spruce is able to maintain itself as a stand component because of these small openings created by windthrow. Stands covering many acres can also be blown down and many young-growth stands originate following the windthrow of the previous stand. The traits of windfirm stands and stands susceptible to damage by wind are documented in Table Silviculture and Timber-3.

Table Silviculture and Timber-3
Traits of Windfirm Stands and Traits of Stands Susceptible to Windthrow

Trait	Windfirm Stands	Susceptible Stands
Age	Young	Old
Age Structure	Even-aged	Uneven-aged
Defect	Low percentage	High percentage
Height	Short	Tall
Stocking	Open stocking on less productive sites, muskeg or scrub stands	Dense stocking on productive sites
Species Composition	Have a high percentage of cedar and hardwoods	Predominately spruce and hemlock
History	Intact with little evidence of recent openings	Previously damaged by windthrow Even-aged pole or young sawtimber opened by thinning or partial cutting

Source: Wind in the Forests of Southeast Alaska and Guides for Reducing Damage, A. S. Harris, PNW-GTR-244.

The management implications of these climate conditions are: (1) moisture is not a limiting factor in tree regeneration, (2) wildfire is not a major problem, (3) high winds can cause heavy losses of timber by windthrow; the relative risk of windthrow determines the range of silvicultural options to meet the management objectives for a given site, and (4) the strong fall winds favor natural regeneration.

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Topography

Topographic features influence the probability of windthrow occurring. The following features may result in decreased windfirmness:

- westerly or easterly aspects where storm winds are accelerated around ridges,
- southerly aspects exposed to onshore winds,
- sideslopes or flats parallel to water channels oriented in a general northwest-southeast direction (especially along the west side of channels),
- flats and valley bottoms at heads of inlets or bays exposed to southerly winds,
- small islands, promontories, or slopes at constrictions of channels with open water to windward, and
- low ridges or upper leeward slopes.

Topography influences the choice of logging methods and silvicultural methods. Historically, most yarding has been downhill because roads are usually located in valley bottoms to avoid the unstable soils on the steep slopes. Cable logging downhill in partial cuts is especially difficult because of inadequate deflection for full suspension and lack of large enough tree root systems for adequate tailholds. Spruce and hemlock are prone to logging damage because of their thin bark and the risk of damage to residual trees is extremely high when attempting to remove trees, particularly on steep slopes using cable logging methods. Stands typically consist of large old trees with significant defect and require large yarders to remove the logs. To control residual stand damage the logging plan must incorporate and the logger must conduct operations following these guidelines: (1) eliminate cross-slope yarding where dragging of logs is involved, (2) during lateral yarding, the skyline must be positioned so that the entire log turn will be suspended above the ground when the logs enter the skyline corridor, (3) yard with the skyline positioned high above the ground to reduce skyline corridor width (lateral excursion), (4) log turns must fly free of the ground in downhill yarding and (5) skyline setting size must be restricted to control the clearcut effect from fan-shaped settings. The inability to meet all of these conditions on most areas generally makes cable logging partial cuts impractical. Other, more costly options, such as helicopters, would have to be used.



Process for Selection of Silvicultural Systems

Both even-aged and uneven-aged silvicultural systems could be selected within the suitable productive forest lands. Factors other than the silvicultural or ecological limitations of the species weigh heavily in the choice between uneven- and even-aged management. These include:

- economic considerations,
- other resource values,
- terrain with its limitation on logging systems, and
- other operational or environmental considerations such as the presence or absence of dwarf mistletoe, susceptibility to windthrow, and susceptibility to logging damage.

The first step in the selection of an appropriate silvicultural system is the diagnosis or range of acceptable treatments, including a deferred (no action, Alternative 1) entry. An acceptable treatment is one that is feasible and has a reasonable expectation of achieving sound silvicultural objectives (species composition, stand condition class, growth rate, density, insect and disease control, and stand development over time).

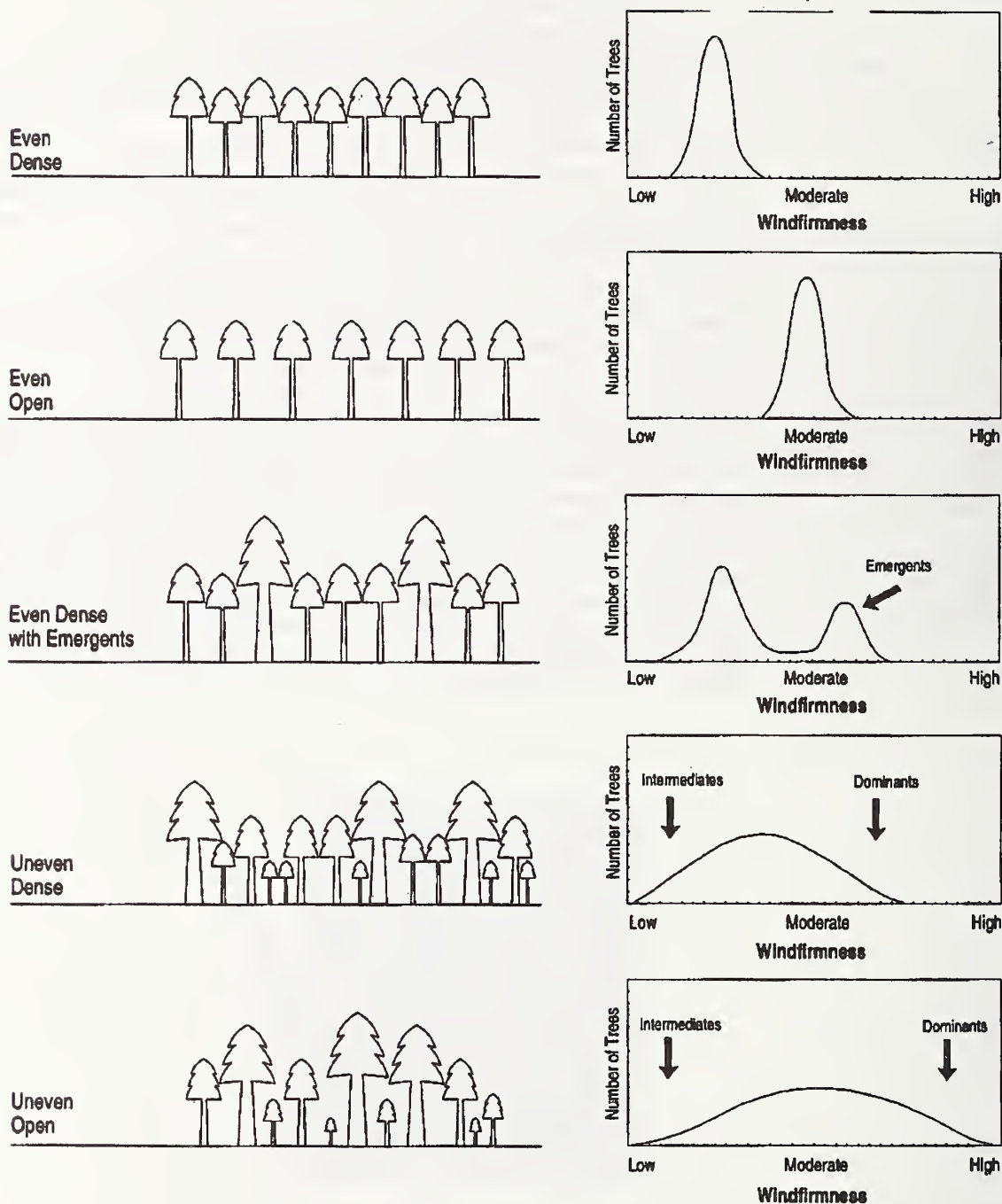
The next step is to use the Forest Plan, management concerns, and public issues to determine the objectives for the site, then select the silvicultural system that best meets the objectives. In order to meet the issues and concerns reflected in the various alternatives, one or more silvicultural system may be selected for the same site, depending upon the alternative.

In Southeast Alaska, the range in silvicultural options is limited by numerous factors, but the most dominant is the risk of windthrow. Areas of high-windthrow risk offer the options to (1) defer entry or to (2) clearcut. Because of risk for stand failure from windthrow, other forms of regeneration harvest have little or no probability of success where long-term timber production is an objective. The one exception to the above statement is where cedar forms a significant component of the stand structure. Because of the extensive top kill caused by cedar decline, the tops of these trees pose little resistance to the wind and are, therefore, relatively windfirm. This is especially true at higher elevations where the soils are frozen rather than saturated during the winter months when the majority of gale-force winds occur. Figure Silviculture and Timber-4 displays the distribution of relative windfirmness of individual trees comprising stands with different structural characteristics.



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Figure Silviculture and Timber-4
Comparison of Distribution of the Relative Windfirmness of Individual Trees.



Clearcut

Areas of moderate-to-low windthrow risk have a full range of silvicultural options available; however, areas of high risk are limited to clearcut. Clearcutting is generally selected for these areas for the following reasons:

1. It is the most effective means of controlling dwarf mistletoe. The removal of infected trees interrupts the life cycle of dwarf mistletoe and reduces the chance for infestation of the future stand. (36 CFR: Criterion 4, Regional Guide: Standard 2, Chief's Policy Letter: Criterion 4)
2. It eliminates windthrow (causes soil loss) in residual (within the cutting boundary) stands. The potential for windthrow increases along cutting boundaries but can be reduced through proper design of cutting units. (36 CFR: Criterion 4, Regional Guide: Standard 2, Chief's Policy Letter: Criterion 4)
3. It eliminates damage to the residual stand. The spruce-hemlock stands are composed of large trees and require large pieces of logging equipment which can cause significant damage to the residual stand. Spruce and hemlock tend to be shallow rooted, and therefore, susceptible to damage from ground based systems; clearcutting reduces these risks. (36 CFR: Criterion 4, Regional Guide: Standard 2, Chief's Policy Letter: Criterion 4)
4. It favors spruce and cedar. The logging operation will destroy some of the advance hemlock regeneration and thus take away its initial advantage. The increased sunlight also favors the spruce. (36 CFR: Criteria 4 and 6, Chief's Policy Letter: Criterion 5)
5. It can improve productivity. The cold air temperature and soil temperature do not favor decomposition of the organic forest floor. Exposing the site by clearcutting raises temperatures, which speeds the decomposition of raw humus and recycling of nutrients, particularly nitrogen. (36 CFR: Criterion 5, Chief's Policy Letter: Criterion 5)
6. It requires less road development. Less road construction is needed to remove a given amount of timber. Clearcuts favor longer spans which also allows for increased spacing between roads. (36 CFR: Criterion 5)
7. It is less costly. Fixed costs are spread over large volumes per acre and logging and road building is more concentrated. (36 CFR: Criterion 3 and 5, Regional Guide: Standard 2)
8. Natural regeneration is generally adequate. Experience with clearcutting since the 1950s has shown that, except for certain situations, attaining natural regeneration is not a problem in the Project Area. Natural regeneration is abundant and generally averages 3,000 to 5,000 stems per acre 10 years after harvest. Competition among seedlings for growing space and nutrients results in reduced growth rates at about age 15 to 20. Stocking control is intended to increase the rate of diameter growth of the remaining trees. Tree size has a significant impact on log values. It improves crown ratios, favors commercially valuable trees (spruce), favors species (forage) or age classes which are most valuable to wildlife, windfirmness may be increased with early thinnings, and other multiple-use objectives may be achieved. (36 CFR: Criterion 2, Chief's Policy Letter: Criterion 4 & 5)



Felling and yarding large trees often damages the remaining stand.

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Partial Cut

Often Land Use Designations (LUDs) that contain selection or group selection harvest systems are lands that will be managed primarily for maintenance and enhancement of resource values other than timber. Generally, any management of the timber resource on these lands will be for stand-maintenance purposes only and will utilize an uneven-aged silvicultural system. Production of high, current or future, timber yields is not a consideration. This system has been applied primarily within stream riparian area boundaries; following the TLMP 1997 Standards and Guidelines.

Stand Maintenance

Stand maintenance is not, strictly, a silvicultural system. Under this management regime or concept, individual trees or small groups of trees are removed if conditions indicate a disease or pest threat to the stand, imminent mortality, severe decline in growth, or if trees are in cable corridors. Stand maintenance, while a form of uneven-aged management, is different than the selection system (group or individual tree) of management. Selection implies strict stocking control and a high intensity of management to maintain a predetermined ratio of tree ages and diameter classes in every stand. The intent with stand maintenance is to manage the timber stand in order to maintain or bring it to the best condition possible until a selection system becomes feasible, or until even-aged management can be made environmentally acceptable. The other possibility is that these stands could be classified as unsuitable for timber production.

Shelterwood

In addition to stand-maintenance prescriptions, the other form of partial cutting being proposed in the Project Area is called a shelterwood harvest. Technically this is referred to as a seed cut in a two-step shelterwood. The purpose of this cut is to provide seed and shelter to promote a new crop of trees. The seed cut is followed (usually 10 to 20 years later) by an overstory removal of the trees left as seed and shelter during the first entry. However, in this Project, the second entry will not be made and the seed-trees will be retained for the full rotation. The purpose of this prescription is to respond to an issue raised during public scoping, and an internal concern, that following clearcutting, natural regeneration of yellowcedar is generally lacking. Alaska yellowcedar forms a significant portion of the following plant associations:

- Western hemlock-yellowcedar- all associations
- Mixed conifer- all associations
- Mountain hemlock-yellowcedar- all associations.

In order to achieve adequate yellowcedar regeneration, it is most often necessary to plant seedlings or use a shelterwood system. The extremely high costs associated with planting helicopter-harvested units make it more practical to use a seedtree or shelterwood system to retain a yellowcedar component.

Silvicultural systems other than clearcutting have not been applied on a large-scale basis in Southeast Alaska. The anticipated results are based primarily on research and experience from other parts of the country.

Reserve-Tree Harvest Strategy (Legacy Structure)

In the reserve-tree harvest strategy, clearcutting with reserves maintains a portion of the existing stand (individual trees, clumps, and groups), creating a two-layered structure with two or more age classes.

The rationale behind using this system is to:

- Provide biological and structural diversity in stands by leaving standing live trees individually or in groups,
- Reduce the impacts to scenic resources, and
- Provide better protection of landslide-prone sites by retaining a living root system.

This stand management system would be incorporated where site-specific conditions permit; 10 to 20 percent of the trees in each timber-harvest unit would be left uncut to improve the habitat quality of second-growth stands in the future (TLMP Final EIS 1997).

Reserve-Tree Selection Criteria

During the planning process, some acreage within the commercial forest land (CFL) classification is identified as unsuitable for timber harvest. These areas are often high-value habitat, riparian areas, Class I and II stream buffers, MMI 4 soils, wildlife corridors, estuary and beach buffers, eagle nest buffers, etc. These areas are usually located adjacent to identified harvest units and are significant to the reserve-tree strategy. If site-specific conditions permit, additional reserve-tree acreage is identified within the harvest unit boundary during the layout phase of the Project.

In a legacy structure system, live reserve-trees are retained indefinitely in groups (within or adjacent to harvest units) or as individual trees scattered throughout the unit. If site-specific conditions permit, the following criteria for selection of reserve areas within a conventional cable harvest unit would be used during the layout phase of the Project:

- Blind lead areas, rock outcrops, small unstable areas, or small wetland areas of concern could be utilized for reserve-tree islands.
- Additional reserve-tree clumps at unit boundaries could be designated where logging feasibility allows.
- Identified stream buffers could be utilized within a unit; these buffers may also be increased in width if additional reserve-tree areas are needed.
- Previously unbuffered streams within a unit could be buffered if needed.
- Reserve-tree islands could be designed between roads if no other option is available and additional reserve-tree acreage is needed.

In units where shelterwood harvest is prescribed by implementing a diameter limit cut, individual scattered trees would be left. These units would require helicopter yarding which would leave smaller diameter trees (usually Alaska yellowcedar) as a seed source.

During harvest-unit layout, minor changes to planned tree reserves may be considered if the majority of the reserve-tree area is left intact. Planned or laid out reserve-tree area selections should not be considered no-cut zones or retention areas. There are various reasons for adjusting reserve-tree areas. Two examples are: (1) not isolating otherwise harvestable patches of timber and (2) correcting setting boundaries to facilitate logging feasibility.

It should be noted that when trees are prescribed to be left within harvest units, Alaska Department of Labor and Occupational Health and Safety Act (OHSa) regulations become paramount. People working around reserve-trees are exposed to a higher risk of danger than would otherwise be encountered in a clearcut with no reserve trees. The Region 10 publication *Reserve-Tree Selection Guidelines* (R10-MB-215, March 1993) is used in the Sea Level planning process for reserve-tree strategies as well as in developing guidelines for

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reserve-tree strategies within harvest units. A more thorough discussion of this publication is presented later in the Timber Section, under Logging Systems.

Specific Treatments

A silvicultural system describes a general silvicultural treatment that will be applied to the units. Clearcut is one such type. Below are modifications to the standard clearcut system that will be applied in the Project Area where necessary, to protect resources, provide for reserve-tree areas, ensure logging feasibility, and provide timber volume.

Even-aged Clearcut

Unit boundary design would adhere to the following criteria wherever the opportunity arose and was practical; however, in most cases they are not requirements.

- Retain tree islands or fingers behind identified blind leads.
- Leave trees in clumps along the unit boundary, where feasible.
- Utilize or expand buffers of Class 1 and 2 streams that flow within and adjacent to the unit.
- Utilize the buffers of previously unbuffered Class 3 streams within the unit, if required.
- Retain tree islands or fingers where there are rock outcrops, steep slopes, areas of MMI 4 soils or wetlands concern.
- Attempt to leave sub-merchantable and unmerchantable timber wherever practical.

Two-aged Clearcut with Reserves or Clearcut with Deferral

Replaces Even-aged clearcuts where the American marten guidelines require 10-20 structure retention. The operator would adhere to the following criteria.

- Follow the Silvicultural Prescription for the quantity and type of leave-trees within the unit.
- Retain snags and sub-merchantable trees throughout unit, as safety conditions allow (see Reserve-Tree Selection Guidelines, Timber Section, Chapter 3, Logging Systems).
- Retain 10 to 20 percent of the original stand structure.
- Retain 4 large trees per acre which are 20 to 30 inches in DBH.
- Retain 3 decadent standing trees per acre which are 20 to 30 inches in DBH.
- Retained trees should have a reasonable assurance of windfirmness and clumping should be used whenever it provides obvious benefits.
- Utilize some Even-aged Clearcut criteria, if required for resource protection.

Size of Harvest Units

The National Forest Management Act of 1976 (NFMA) specifies a limit on the size of a forest opening which may be created based on the forest type. For the western hemlock/Sitka spruce forest type associated with Southeast Alaska, this maximum opening size is 100 acres. The NFMA provides leeway for extending this opening size to 150 acres under certain conditions, such as timber economics, regeneration requirements, wildlife or fisheries habitat needs, transportation or harvest system requirements, etc., and for exceeding 200 acres under extreme circumstances such as major insect and disease outbreak, fire, windthrow, or other form of catastrophic damage.

None of the alternatives propose harvest units over 100 acres in size.

Proposed Harvest by Site Class

Because some site classes are more productive than others, they are rated by a site index and are assigned a class of low, medium, or high. The site index is based on the expected height to which a tree will grow, on that site within a given number of years (in this case 50 years). On low sites, trees would be expected to grow between 45 and 56 feet in height in 50 years. On medium sites, trees would be expected to grow between 57 and 66 feet in height in 50 years. On high sites, trees would be expected to grow more than 77 feet high in 50 years. In general, more timber can be grown at less cost on a high site than on a medium or low site, and more timber can be grown at less cost on a medium site than on a low site. However, by mixing high, medium, and low sites, average logging costs for low sites can be reduced and more land is available for timber management over the rotation.

Table Silviculture and Timber-4 displays the approximate percentage of proposed harvest for each alternative by site class.

Table Silviculture and Timber-4
Acres of Proposed Harvest by Site Class (Productivity)

Alternative	Low Percent	Medium Percent	High Percent	Total Percent
1	0	0	0	0
2	1	44	55	100
5	1	37	62	100
7	2	41	57	100

Source: Trulock 1998.

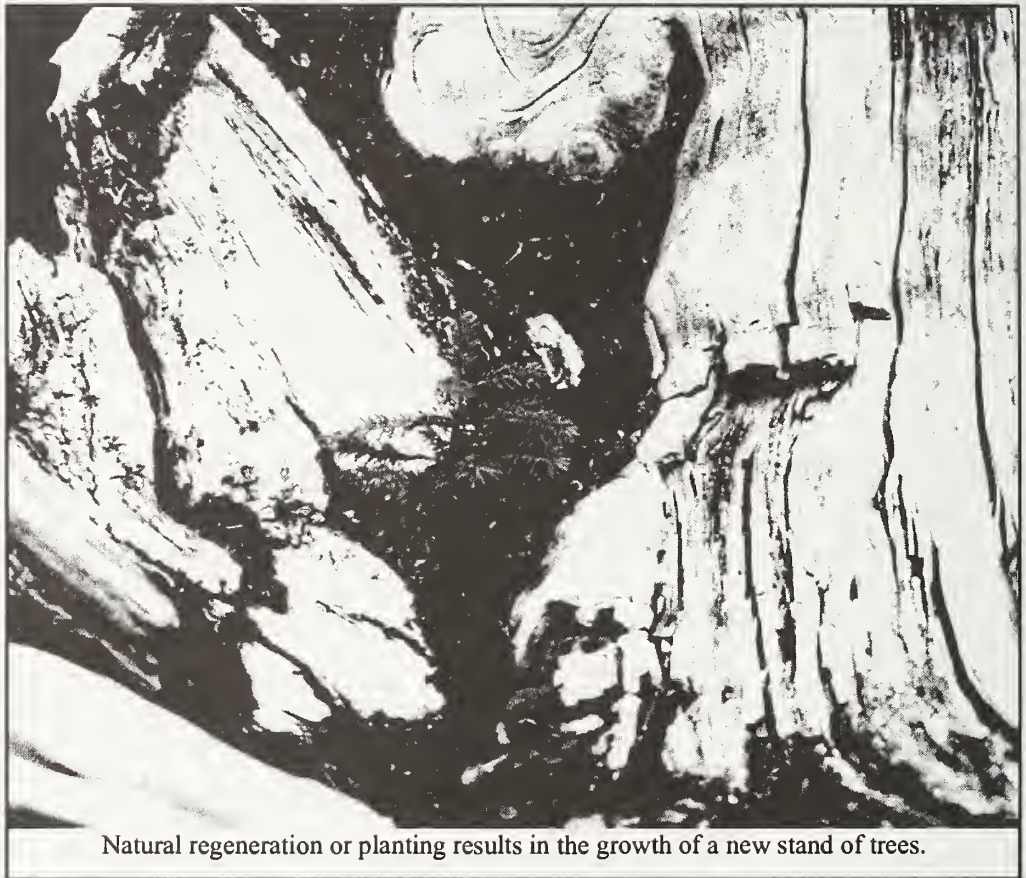
Note: This information derived from Ketchikan Area GIS, CLU data layer.

Indirect and Cumulative Effects

Regeneration

All of the areas proposed for timber harvest will be restocked within 5 years as required under the NFMA. A combination of natural regeneration and artificial regeneration (tree planting) will be utilized to restock harvested areas (see Appendix E). Prescribed fire for site preparation is not being proposed for any of the alternatives.

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Natural regeneration or planting results in the growth of a new stand of trees.

Harvested sites must contain a minimum of 300 well-dispersed trees per acre by the 5th year following harvest to be considered successfully regenerated. Survival (staked tree) surveys will be conducted on all planted sites the first and third full growing seasons after being planted. Regeneration-stocking surveys must be conducted on all harvest units the third full growing season after yarding is complete. A 3rd-year survey is used to determine whether or not additional reforestation efforts are required. A 5th-year survey is used primarily to certify that the regeneration process has been successful on areas which did not meet the requirements in the 3rd year. Table Silviculture and Timber-5 shows the acres of essential reforestation treatments to be performed by alternative. It should be recognized that areas requiring artificial regeneration cannot be accurately identified until after harvest when the 3rd-year stocking surveys indicate inadequate natural regeneration. Thus, acreage figures may change at the time planting would occur.

Table Silviculture and Timber-5
Anticipated Essential Reforestation Treatments, by Alternative in Acres

Alternative	Natural Regeneration Surveys 3 & 5 years	Plantation Stocking Surveys 1 & 3 years	Prescribed Tree Planting
1	0	0	0
2	2,857	72	72
5	867	14	14
7	1,828	55	55

Source: Trulock 1998.

Note: This information derived from Ketchikan Area GIS, Sea Level Silviculture Coverage.

Long-Term Timber Productivity (Yield)

The effects of all action alternatives on long-term yield would be the conversion of unmanaged, overmature stands to managed, faster growing, primarily early seral, even-aged stands. Overmature stands have lower forest-floor temperatures than even-aged stands, thus reducing biological activity. Organic decomposition slows, and as a result, the supply of available nutrients is reduced. With decreased biological activity, less nitrogen is available for tree growth and nutritional status is lowered. While overmature stand growth and vigor remain nearly constant, they are at a level below that of even-aged stands (Harris et al. 1974). Table Silviculture and Timber-6 displays the average structural characteristics of managed stands by site classification—low, medium, and high.



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Table Silviculture and Timber-6
Average Structural Characteristics of Managed Stands (by Site Classification)

Stand Age (years)	Height (feet)	DBH (inches)	Volume/Acre (board feet)*
Low Site			
5-20	26	1.4	0
20-50	56	4.9	1,900
50-80	82	8.5	14,100
80-100	96	10.8	25,500
100-120	107	12.8	37,100
120-160	122	16.4	56,800
Medium Site			
5-20	29	3.5	0
20-50	66	9.8	7,400
50-80	98	13.6	29,800
80-100	114	15.7	46,100
100-120	126	17.8	61,400
120-160	144	21.3	81,900
High Site			
5-20	31	4.0	100
20-50	77	11.0	13,900
50-80	111	15.2	43,400
80-100	127	17.5	62,400
100-120	139	20.1	78,000
120-160	157	24.1	100,300

Source: Forest Service 1991.
 * Net Sawlog.

Regeneration quantity, quality, and sustainability have been on-going issues with regards to organic forested wetlands and karst landscapes. The Project Area has some areas underlain by carbonate bedrock with karst features of limited development and extent. Similar areas within the Project Area that are underlain by carbonate rock and that have been previously harvested show no significant problems regarding regeneration or growth rates. On the low- to- moderate-vulnerability karst lands, where mineral or glacially-derived soils fully or partially cover the epikarst, forest regeneration is exceptional. In these areas even the complete loss of soil and litter from the surface of the limestone will not prohibit the re-establishment of a forest, since displaced surface materials are retained within the epikarst channels (TLMP 1997).

Certain organic wetlands have been excluded from harvest with the exception of inclusions less than 2 acres within harvest units (TLMP ROD 1997). These soils are currently the topic of ongoing research to determine their suitability for timber harvest. Historically, these sites were planted as mitigation to harvest. The Sea Level Project excludes these soil types from units and attempts to protect area or mitigate impacts to other organic wetland soils wherever possible within the project. The Ketchikan Ranger District has recently begun gathering growth information informally from a number of areas on the District and plotting these growth rates for stands up to 40 years in age. These informal glimpses show a reduced rate of growth on organic wetlands that is commensurate, as would be expected, with the reduced site productivity and site index rating given to that soil type. This should in no way preclude the sites from harvest, but should call for longer rotations, provided the site rating qualifies as commercial forest land. (See the Riparian Areas, Floodplains, and Wetlands portion of this chapter for more specific information on wetlands).

The magnitude of the effect of converting unmanaged, overmature stands to managed, even-age stands will vary depending upon the number of acres harvested in each site class. Table Silviculture and Timber-7 shows that Alternative 2 converts the most acres to managed condition (2,857 acres), followed by Alternative 7 (1,828 acres), and Alternative 5 (847 acres). Alternative 1 proposes no timber harvest and will not convert any stands to a managed condition.

All stands proposed for harvest are overmature and well beyond the age of maximum average annual growth of the stand. They are representative of uneven-aged western hemlock stands that commonly take hundreds of years to develop under natural conditions (that is, unless they are changed by natural events such as windthrow, soil movement or manipulated by intensive forest management practices).

The open conditions created by clearcutting allow both Sitka spruce and western hemlock to regenerate rapidly. Even-aged stands are generally comprised of 10 to 75 percent spruce, depending on the soil type and age of the stand. On average, the volume of spruce in even-aged stands 75 to 100 years after harvest is about 50 percent (Taylor 1934) compared to 28 percent in existing overmature stands. With the use of precommercial thinning, an additional 10 percent increase in the spruce component is expected.

Precommercial Thinning

Regeneration of naturally disturbed or harvested areas may result in average stocking levels of seedlings/saplings of 4,000 stems per acre. Although these stands will eventually thin naturally, production of usable wood fiber would be hastened if stocking were decreased through precommercial thinning (Harris and Farr 1974). Growth and yield models indicate that for every acre precommercially thinned, timber yield increases by 6.9 MBF on medium and 8.9 MBF on high sites, over a 100-year rotation. Precommercial thinning reduces the competition for sunlight, moisture, and nutrients in what is often referred to as growing space. This additional growing space results in accelerated growth rates for longer time periods than unthinned, second-growth stands.

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Precommercial thinning can also be used to change species composition and windfirmness of the stand. It should be recognized that precommercial thinning is performed approximately 15 to 20 years after harvest and is dependent upon site, stocking, and other resource needs. Table Silviculture and Timber-7 shows the number of acres that have been identified, by alternative, for scheduled and potential precommercial thinning in the future.

Table Silviculture and Timber-7
Potential Precommercial Thinning Acres, 15 to 20 Years after Harvesting

Alternative	Scheduled	Potential
1	0	0
2	2,420	2,420
5	818	818
7	1,766	1,766

Source: Trulock 1998.

Note: This information derived from Ketchikan Area GIS, Sea Level, Silviculture Coverage.

Although log quality in young-growth stands is expected to be lower than in existing overmature stands (even on sites that have been precommercially thinned), total yield per acre will be significantly higher in second-growth stands. The lower quality will be reflected in the log grades, with second-growth timber stands having fewer top grade logs than existing overmature stands. In addition, second-growth stands will have less volume in the larger diameter classes. The long-term result of precommercial thinning is, more usable wood fiber. Precommercial thinning also allows the option of reducing the economic rotation age. This is because merchantable size logs are produced at an earlier age if the site is thinned.

Most second-growth even-aged stands will exhibit less variation in tree diameter and height than the overmature stands they replace. At 100 years of age, average diameters for unmanaged second-growth stands will range from 13 inches on medium sites to 15 inches on high sites. With precommercial thinning, it is possible to produce average stand diameters that approximate old-growth averages; at age 100, diameters can range from 16 inches on medium sites to more than 18 inches on high sites (Forest Service 1990).



Precommercial thinning prolongs understory vegetation and enhances growth rates on the remaining trees.

Young-Growth Management for Other Resource Values

Fisheries Rehabilitation

A significant percentage of the Riparian Management Areas (see Aquatics Section, Chapter Three) within the Project Area were harvested between 1954 and 1993. Much of this timber harvest occurred 10 to 20 years ago, before any significant stream protection measures were implemented. As a result, many Class I and Class II streams, that today would receive a stream buffer, were harvested up to the bank.

Riparian Management Areas previously harvested for timber are now in various stages of secondary plant succession. Except where the ground was highly disturbed, the stand composition on these areas is similar to riparian vegetation prior to timber harvest, with Sitka spruce typically forming the canopy. On the more disturbed sites, where mineral soil was exposed during timber harvest activities, the vegetation is often composed of early successional species, such as red alder and salmonberry.

Many studies have established the need for large woody debris (LWD) material in streams. It is an important component to bedload dynamics as well as providing structure, habitat, and nutrients. Existing riparian stands of extremely dense conifers or alder, similar to those in Painted Creek for example, will require a long period of time (150-200 years) to develop large material for recruitment. Management of these existing riparian stands could produce the same size material for recruitment much sooner. In a high site-index stand (most riparian sites are very productive), a precommercial thinning at age 15 (to maintain growth rates and promote windfirmness), followed by a second precommercial thinning at age 40 to 50 (with

variable-spaced thinning of lower DBHs and a higher DBHs that would girdle rather than fell the trees) could produce 5 to 24 snags over 15 inches in diameter per acre. This would also promote the initial development of a two-storied stand. A third noncommercial entry at age 75, utilizing a combination of high and low thinning by girdling rather than felling, could create as many as 6 to 10 snags over 24 inches in diameter per acre. The objective of this type of treatment would be to promote a multi-storied canopy layer over time, promote habitat for snag-dependent wildlife and, as the snags fall over, provide LWD much sooner than would occur naturally. A site-specific silvicultural prescription that incorporates the concepts listed above could be prepared if funding is available for fisheries rehabilitation work.

Wildlife Management

The structure and composition of young-growth stands are dramatically different than those of old growth. Second-growth management is not intended to mimic or replace the need for old growth (see Biodiversity section, Chapter 3). It is possible to achieve commodity production objectives in a way that lessens the negative impacts upon certain wildlife habitat needs through the application of ecosystem management principles.

Young-growth stands that before harvest were part of historic wildlife-travel-corridors or important winter habitat (low elevation, south aspect, productive site) would benefit from precommercial thinning. The key to this strategy is to extend the rotation (example 200 years) and not manage for short-term benefits at the beginning of the rotation, but to emphasize wildlife values over the last 100 years of the extended rotation. For example, a combination of low thinning and girdling could create snag habitat by age 50-60 years; subsequent girdling every 30-40 years would maintain snag habitat as well as allow for recruitment of forbs and shrubs back into the site much sooner than would occur naturally. The extended rotation would assure that these benefits accrue over a longer period of time.

A site-specific silvicultural prescription that incorporates these concepts would be prepared in coordination with a wildlife biologist prior to implementation, should funding be available. Due to the fact that most second-growth management prescriptions to promote other resource values are somewhat experimental (very few examples of managed older second-growth exist), the potential benefits were not used in modeling future wildlife/fisheries or other resource values.

Plant-Community Successional Stages Including Old Growth

After reforestation, managed forests grow through several distinctive successional stages which generally are applicable to all units proposed for harvest. Characteristics such as height, diameter and productivity vary according to site class. Different components dominate the stand at different stages and the overall forest structure changes over time.

Seedling/Sapling Stage

The first 20 years following harvest is referred to as the seedling-sapling understory colonization stage. During the first 5 years of this stage, the young stand receives maximum sunlight, resulting in the rapid establishment of a variety of shrubs, forbs, and grasses. There is little incidence of damage or mortality from disease or infestation at this stage. The changed structure of the harvested stand affects the structure of adjacent stands—windthrow potential increases with greater wind exposure and understory development accelerates due to increased sunlight through the newly developing stand.

In years 5 to 20, seedlings grow into a vigorous new forest of trees, averaging about 20 feet in height and 1 to 3 inches DBH. Understory production of woody-stemmed species is at its highest, especially on blueberry dominated sites. Larger dead materials from the original stand begin to decompose, and the stand edge is stabilized, resulting in less windthrow to the adjacent stand(s). At the end of this successional stage, the stand can be considered for precommercial thinning, leaving a species composition of about 60 percent western hemlock, 40 percent Sitka spruce, and a small cedar component.

Future harvest, through to 2007, would add to the total acreage comprised of this stage in the Project Area. Alternative 2, which harvests the maximum amount of timber allowed under Forest Plan Standards and Guidelines, has been used to project the level of harvest through 2007. It is assumed that a reduced level of harvest in a current alternative will result in more harvestable volume in a future entry. To do otherwise would require a change in the land use allocation, which is beyond the scope of this document.

Pole/Young-Sawtimber Stage

The pole successional stage occurs during years 20 to 50 following harvest and is referred to as the understory exclusion stage. It is characterized by accelerated tree growth (approximately 1 foot per year) and a rapidly closing tree crown canopy. At age 50, tree heights range from 48 to 72 feet and diameters range from 5 to 10 inches, depending on the site class. Tree crowns begin to grow closer together, causing the understory to change from a dense shrub, herb and seedling-dominated structure to one of dense moss. Stands which have been precommercially thinned will have a two-layered canopy with western hemlock in the lower story. Canopy closure will occur more slowly in precommercially thinned sites.



Managed forests progress through several distinctive successional stages.

In years 50 to 80, the young sawtimber successional stage occurs and the stand remains closed. At age 80, tree heights range from 74 to 107 feet and diameters range from 8 to 13 inches, depending on site class. Little sunlight reaches the forest floor, and the understory continues to be dominated by moss. Tree diameter growth slows to about 1 inch every 10 years, as competition between trees increases. It is not currently economically feasible to commercially thin trees at this stage, but thinning would increase growth and diversity of the shrub layer, as well as increase diameter growth of the remaining trees. The Ketchikan Ranger District is proceeding with plans to attempt some commercial thinning, for purposes not directly related to timber production, with the hope that the product will pay for the proposed treatment.

Because there are no activities, planned or existing, in existing harvest units, the only change that occurs is the growth of some of the existing harvest units into the pole/young sawtimber stage. Thus, each alternative shows the same number of acres in this successional stage before and after implementation.

Mature-Sawtimber Stage

When the stand becomes 80- to 100-years old it has reached the mature, even-aged forest and understory reinitiation stage. At age 100, tree heights range from 88 to 123 feet and average stand diameters range from 10 to 15 inches, depending on site class. Some trees may die, while others become clearly dominant in size. Diameter growth remains at less than 1 inch every 10 years. Moss continues to dominate the understory, except in places where the canopy has opened and allowed sufficient light for herbaceous plants. These

structural characteristics continue into the later stages of the stand (approximately 100 to 160

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years) with continued slow growth and occasional openings in the canopy (Forest Service 1989).

Old-Growth Stage

The final successional stage for a forest is the old-growth stage (160 years and up). This stage is characterized by a multi-storied structure with a large over-mature overstory composed of live and dead trees and an understory of mostly shade-tolerant western hemlock. There would be a substantial component of downed large trees and occasional openings in the forest canopy. Patches of shrubs, tree saplings, and herbs alternate with patches of overmature timber, creating a complex, multi-layered mosaic. The stand declines in growth and has the highest degree of variation and the most structurally diverse understory of any successional stage.

Some stands are prescribed for old-growth conditions. Stands which have been deferred from harvest are in an old-growth stage. The cumulative effects of harvesting old growth will result in the conversion of large areas to a mosaic of second-growth sites of differing age classes.



Timber: Affected Environment

Forest Land Classification

The 91,747 acres of land within the Sea Level Project Area are defined as National Forest System lands and are categorized as all forested or nonforested lands. Figure Silviculture and Timber-5 displays the breakdown of the various forest land classifications within the Project Area.

Nonforested

Nonforested Land refers to National Forest System land that is biologically unable to support a cover of predominantly timbered vegetation. This includes muskeg, rock out-croppings, talus slopes, and water bodies, among others. About 4.7 percent (approximately 4,282 acres) of the Project Area falls into this category.

Forested

Forested Land refers to National Forest System land that consists largely of timbered vegetation and is further categorized as Commercial Forest Land (CFL) or Noncommercial Forest Land. There are about 87,465 acres (95.3 percent) of the Project Area that fall into this category.

Noncommercial Forest Land (Non-CFL)

Noncommercial Forest Land does not support enough timber volume to meet the criteria for CFL. The Project Area forested land area contains about 40 percent (36,575 acres) of Noncommercial Forest Land.

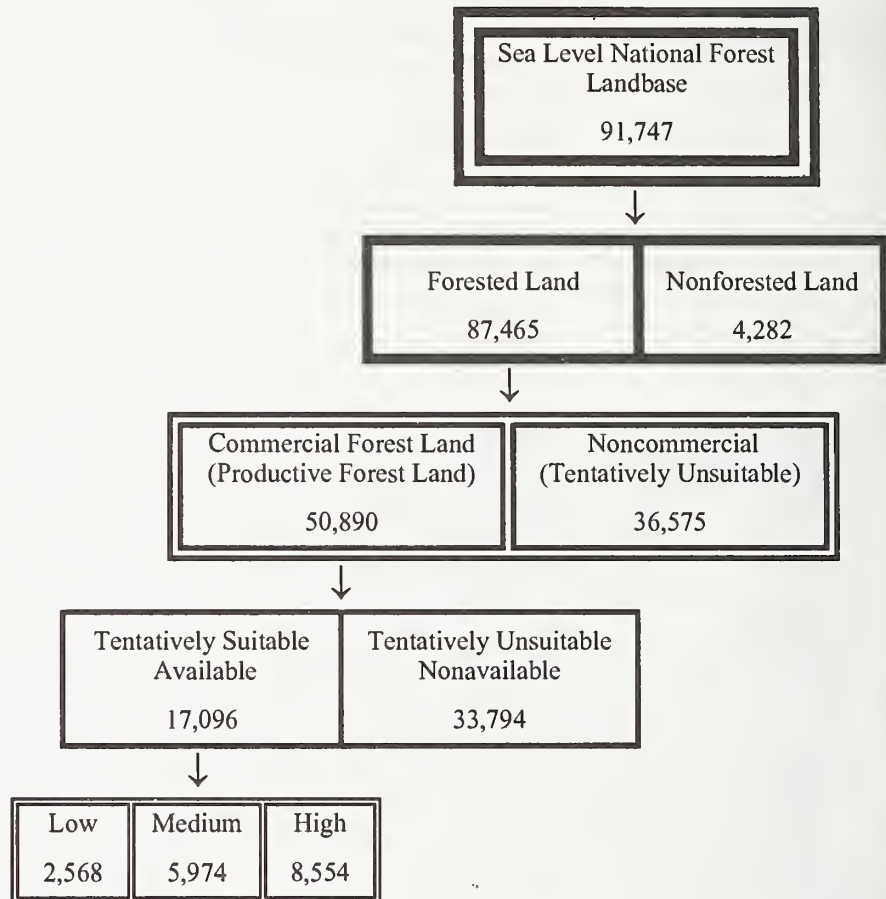
Commercial Forest Land (CFL)

Commercial Forest Land is capable of producing continuous crops of timber. The Forest Service has specified that each acre of CFL must be capable of producing 20 cubic feet of tree growth annually or must contain at least 8 thousand board feet (MBF) of net timber volume (USDA Forest Service 1977a). Old-growth and second-growth stands may qualify as CFL. The Sea Level Project Area (forested area) is composed of about 55 percent (50,890 acres) CFL.

Figure Silviculture and Timber-5 identifies the components of the CFL.

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Figure Silviculture and Timber-5
Sea Level National Forest Landbase (Acres)



Source: GIS Database information 1997.

Tentatively Suitable Forest Lands

Commercial Forest Land suitability is further subdivided as to its suitability undergoing review as identified in Appendix A of the TLMP Final EIS (1997).

To be considered Tentatively Suitable, the CFL must:

- have the biological capability to produce crops of industrial wood,
- not be developed for nontimber production uses,
- be harvestable with available technology to ensure timber production without irreversible resource damage to soil productivity or watershed conditions,
- be restockable within 5 years after harvest,

- have adequate information available to project response to timber management practices, and
- have not been withdrawn legislatively from a timber production classification.

Suitable Forest Lands

Tentatively Suitable is further subdivided into Suitable and Unsuitable Forest Lands. For the purposes of this analysis, all lands which have a management prescription or proposed management prescription that precludes timber harvest are eliminated from the Tentatively Suitable base. The remainder are classified as suitable.

To be considered suitable for harvest, these forested lands must have a LUD which allows commercial timber harvest.

For this process, Project Area lands have also been deferred from the suitable base if they have a TLMP Final EIS (1997) LUD prescription that does not permit commercial timber harvest.

Lands withdrawn from the Tentatively Suitable, not contributing to the suitable base considered for this project, include:

- encumbered lands (see Chapter 1),
- buffers mandated by the Tongass Timber Reform Act on certain fish-bearing streams,
- lake and pond buffers,
- 1,000-foot buffers around the saltwater shoreline,
- oversteepened slopes of 72 percent and greater,
- MMI 4 or very high hazard soils,
- riparian management area buffers,
- small, medium, and large old-growth reserves,
- existing young growth,
- 1,000-foot buffers around estuaries, and
- 330-foot buffers around all known eagle nests.

About 45 percent of the Project Area (approximately 40,857 acres) is non-CFL. Approximately 19 percent of the Project Area (17,096 acres) is suitable and available (see Figure Silviculture and Timber-4).

Suitable Base

Previous harvest within the Project Area has largely used clearcut logging methods. Previous timber harvests have occurred within the Project Area for both the long-term and the independent sale program. Previously harvested timber stands (second growth) were considered unavailable for timber harvest for this project analysis. About 6,705 acres have been previously harvested from the suitable base (23,801 acres) within the Sea Level Project Area, excluding encumbered lands.

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Volume Strata

The CFL in the Tongass National Forest has been classified into different volume class ranges based on per acre volume estimates. In the mid-1970s the Forest Service contracted an independent consulting firm to assign volume per acre for all lands on the Ketchikan Administrative Area. This inventory estimated timber and landform conditions based upon aerial photo interpretation. This volume per acre data was stratified into four different volume classes which were used to describe the volume range of timber per acre in thousands of board feet (MBF).

Several concerns and subsequent studies regarding the reliability of this information (usually referred to as the TIMTYP map) have been expressed both within and outside the agency (TLMP 1997). Jim Brickell (USDA-Forest Service, Region 1 Biometrician) was commissioned in 1989 to address concerns about the TIMTYP map reliability. Brickell found that: (1) there is no practical or statistical difference in three of the four sawtimber strata with respect to mean board feet per acre, (2) the prospect of being able to interpret the existing timber type map in terms of sawtimber volume per acres seems dim, and (3) from information taken in the field in the forest inventory, it appears that a fairly large proportion of the polygons were not classified correctly as to stratum.

Because of these and other issues, alternative methods of assigning site quality (or the capability to produce different timber volumes) to lands currently supporting old-growth forests have been considered for purposes of the Forest Plan revision. Five different options were studied and evaluated. Statistical analysis indicates that three strata can be distinguished for the available timberlands (lands not legislatively or administratively withdrawn) using the existing inventory with additional information on soils and slopes. The polygon characteristics of the three strata approach are displayed in Table Silviculture and Timber-8.

Table Silviculture and Timber-8
Volume Range Within TIMTYPE Volume Classes as Identified in the 1979 Forest Plan (Amended 1985) and the 1997 Forest Plan (TLMP 1997, Timber 3-255, Table 3-72)

Three Strata Volume classes	Volume/Acre (MBF/Acre)
Low	13.9
Medium	23.3
High	29.9

Source: TLMP 1997.

Volume Estimates

Stand inventory data contributing to the original volume per acre data was composed of on-the-ground evaluations of stand characteristics and capabilities. For the Project Area, cruise certified Ketchikan Ranger District field crews performed stand examination plots on the unit pool identified in the Project Position Statement. In addition, these plots were also measured as actual cruise plots and will be used to supply timber volume data in the planning process and through project implementation. These stand exam/cruise plots were randomly distributed throughout all of the initial Logging and Transportation Analysis (LSTA) identified harvest units (potential harvest unit pool).

Based on the above project volume analysis, this data is statistically relevant for Project Area estimations (overall Project Area sampling error for Alternative 2 is 9.61 percent) and is an adequate predictor of volume per acre by volume class. Table Silviculture and Timber-9

displays the net volume per acre excluding utility and right-of-way (ROW) volume by volume class.

In the past, spruce and hemlock utility volume on the Ketchikan Area was calculated as a percentage of the gross standing cull (gross defect within trees) and added back into the total net volume per species. In 1997, a Ketchikan study on 2 million scaled logs was performed (Joe Thompson, SO Timber Staff, 1997). This study showed that generally, timber cruises were accurate in predicting sale volumes, but significant opportunity existed to obtain more accurate results by changing the procedure for calculating utility volumes. The study showed that spruce and hemlock utility volumes are actually a part of the sawlog component, not part of the standing log cull component as previously calculated. A letter dated May 6, 1997, directs Ketchikan Area District Rangers to calculate spruce and hemlock utility based on sawlog content, not gross standing cull.

Table Silviculture and Timber-9
Estimated Average Net Volume per Acre by Alternative (including Utility) and Volume Class

Alternative	Volume Class MBF/Acre		
	Low	Medium	High
2	11.40	23.41	26.66
5	10.92	19.08	27.36
7	12.62	20.39	27.03

Source: Marks 1997.

These volume per acre figures are used to calculate planned harvest unit volumes throughout the Sea Level EIS planning process as exhibited in Table Silviculture and Timber-10 as well as in midmarket calculations.

Effects of the Alternatives

A result of the harvest of timber, as identified in designed harvest units, is the harvest of timber within designated right-of-ways (ROWs). ROWs are designed to be the most economical access to the present and future timber resource, in line with protecting and serving other resource needs and meeting Forest Service Standards and Guidelines. Consequently, the volume and type of timber harvested within ROWs is considered incidental to the proposed timber harvest. Table Silviculture and Timber-10 displays the estimated volumes of ROW timber proposed for incidental harvest with each alternative. These estimates are based on cruise data taken by District stand exam crews and planned road locations generated electronically through the Ketchikan Area's Geographic Information System (GIS). Actual area and volume will be established prior to the offering. For more ROW information see the Roads and Facilities section of this chapter.

Table Silviculture and Timber-10
Proposed Harvest Volume by Alternative

VCU	Alternative			
	1	2	5	7
	0	71,389	20,353	46,886
Right-of-Way Volume*	0	5,840	1,810	4,000
Total Volume MBF	0	77,229	22,163	50,886

Source: Ketchikan Area GIS, Oien, Trulock, Marks 1998.

*Right-of-way volume calculated using average volumes per acre by alternative and adjusting for right-of-way through muskegs and low volume timber stands. Includes temporary road volume outside units.

Cumulative Effects

Cumulative effects result from the incremental effect of an action when added to the past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time. This section summarizes the effects of the proposed Sea Level harvest upon the environment in combination with the effects of past and proposed future actions. The suitability analysis performed for this project (see Affected Environment) identified a total of 17,096 acres of suitable and available forest land, (6,705 acres previously harvested is not included in this figure) and available for future harvest.

Table Silviculture and Timber-11
Available Tentatively Suitable Acres by Volume Strata

Strata	Alternative	
	2, 5	7
Low	2,568	2,552
Medium	5,974	5,972
High	8,554	7,980
Total	17,096	16,781

Source: Ketchikan Ranger District GIS 1998.

* See Silviculture/Timber Figure

Reduction of acres is the result of moving the small old-growth habitat reserve in VCU 7560 from Minx Flat to Gnat Cove. This reduction represents approximately 23 MMBF.

Table Silviculture and Timber-12 displays the acres and percentage of each volume class proposed for harvest, by alternative.

Table Silviculture and Timber-12
Distribution Percent and Acres, for Proposed Harvest Units by Volume Strata and Alternative

Alternative	Volume Strata Low		Volume Strata Medium		Volume Strata High		Total Acres
	Acres	Percent	Acres	Percent	Acres	Percent	
1	0	0	0	0	0	0	0
2	86	3	915	32	1,856	65	2,857
5	38	4	229	27	600	69	867
7	77	4	561	31	1,189	65	1,827

Source: Ketchikan GIS 1998.

Project Purpose and Need

By the year 2007, approximately 17 percent (2857 acres) of the suitable and available base (17,096 acres) is available for harvest. The scheduled acreage in Alternative 2, combined with the acreage previously harvested (6,705 acres of second-growth), equals approximately 56 percent of the suitable base (23,801). By the end of the forest rotation, in approximately 2095, all suitable volume would be scheduled for harvest to attain the desired future condition. Future timber harvest within the Project Area could occur as summarized in Table Silviculture and Timber-13.

Table Silviculture and Timber-13
Cumulative Effects of Timber Entry into the Project Area

Alt.	Acres of Proposed Harvest	Percent of Suitable Base Harvested this Draft EIS	Acres of Potential Harvest 2000 to 2007	Percent of Suitable Base Harvested by 2007	Acres of Future Harvest 2007 to 2095	Percent of Suitable CFL Harvested between 1955 to 2095 (Cumulative)	Percent of CFL Harvested 1955 to 2095
1	0	0	2,857	17	14,239	100	47
2	2,857	17	0	17	14,239	100	47
5	867	5	1,990	17	14,239	100	47
7	1,827	11	1,030	17	13,924*	100	47

Source: GIS/Nightingale, Grundy 1998.

*This reduction is the result of moving the small old-growth habitat reserve from Mop Point to Gnat Cove.

Logging Systems

Yarding is the process of conveying logs from the stump to the landing. The method used depends upon many factors including access, topography, slope, and resource protection needs (log suspension requirements).

Ground-Based Yarding

Moist, soft soil conditions in relation with steep slopes found in the Project Area prove difficult for ground-based equipment operation. Except for a limited amount of shovel logging with track-mounted log loaders, there has been little opportunity for this type of equipment.

Shovel Yarding

Shovel logging yarding systems utilize a lower center of gravity making these machines more stable, lighter, and agile. They also produce a lighter footprint or ground pressure. Partial suspension requirements are met by this type of yarding system. Shovel yarding is a system of short-distance logging in which logs are moved from the stump to the landing by repeated swinging with a swing-boom log loader. The loader is walked off the haul road and out into the harvest unit. Logs are moved and decked progressively closer to the haul road with each pass of the loader. When logs are finally decked at roadside, the same loader, or a different

loader, loads out trucks. On gentle ground (<20 percent slope), logs are either hceled and swung or dragged by the boom as it rotates. While the Project Area LSTA process classified units as either cable or helicopter yarded, certain portions of cable units, especially along ROWs, were identified suitable for shovel yarding. Currently, approximately ten percent of an average sale area is being shovel yarded. The decision to actually specify shovel yarding within a given unit is made at the time of unit layout.

Cable Yarding

Traditional cable yarding throughout the Ketchikan Area was comprised of approximately 20 percent slackline yarding, 30 percent running skyline, and 35 percent highlead (Marks 1997). With the advent of the newly released TLMP American Marten Standards and Guidelines, cable yarding configurations will change to include systems which have lateral yarding capability, especially within timber units designated for partial-cutting prescriptions (see Silviculture section for American marten prescriptions). Within the Project Area, a majority of small skyline systems (rigged live or running with carriage) and a minor usage of slackline and high lead (Grabinski), will account for harvest methods proposed in each alternative (see Table Silviculture and Timber-14). Skyline yarding systems inherently provide partial suspension or log lift in a majority of situations, and when required, this system can be designed to provide increased log suspension to meet required management objectives.

By direction, the Forest Service plans and appraises for the most economical yarding system feasible for a particular harvest setting, provided it meets management objectives and suspension requirements for the unit. Within the planning process, the running skyline yarding system is used in place of highlead yarding because it is more economical. If at the time of actual unit layout there are no management objectives that require partial suspension (increased log suspension), the highlead yarding system may be utilized.

Highlead Systems

Highlead systems (including Grabinski or rider block) were previously used more than any other cable system. A two-drum yarder is used. These yarders are typically 90 to 110 foot towers which have telescoping tubes and are tied down with six or eight cables or guywires. One drum holds the mainline which attaches to butt rigging with chokers. The other drum holds the haulback line which supports the rider or bull block. The haulback also continues on through a block (pulley) and attaches to the other side of the butt rigging. The mainline and haulback control the inhaul and outhaul of the butt rigging. The term "highlead" refers to the location of the mainline block which is elevated above the ground by the spar. The mainline block (bull or rider block) provides some vertical lift enabling logs to override obstacles, thus minimizing soil disturbance as a "turn" of logs is inhaled to the landing. This system provides some partial suspension and is usually designated in areas that have minimal risk of soil disturbance. This system's maximum yarding distance is 1,500 feet uphill and 600 feet downhill. Additional suspension requirements, as well as entry into more difficult terrain requiring longer reaches, favors other systems with expanded capabilities.

Running Skyline Systems

Running skyline systems require a three-drum "swing" or a tower yarder which include a mainline, haulback and slackpulling lines with hydraulic interlocking capabilities. These yarders are typically shorter (50 to 70 feet) and in the case of a swing yarder, are usually a leaning lattice type tower that can swing to either side allowing a turn of logs to swing toward a log loader. The interlock system hydraulically ties all three drums together (which rotate at different speeds) to increase overall lifting capability, especially when rigged in a downhill yarding configuration (where braking the haulback line provides the actual log lift or suspension). This system can utilize either a mechanical slack pulling carriage or a mechanical grapple. Both are directly supported by the haulback line. When a grapple is utilized, the slackline and mainline drums control the operation of the grapple which open and closes around selected logs which, in turn, are yarded to the landing. When a mechanical slackpulling carriage is utilized, the same two drums are used to control the inhaul or outhaul

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of the skidding line/chokers. While each type of carriage is in common use and provide distinct production advantages, they both provide partial suspension capabilities required to meet most soil management objectives. This system inherently provides increased log lift due to its hydraulic interlocking capabilities. Maximum yarding distance is 1,000 feet uphill and 600 feet downhill.

Live Skyline (Shotgun/Flyer) Systems

Live skyline (shotgun/flyer) systems feature a moving skyline cable which raises and lowers a simple carriage with chokers to a turn of logs. The mainline on a highlead yarder (two-drum tower) is used as the skyline and the haulback is used as the mainline, to control carriage inhaul/outhaul. The carriage is gravity outhauled with the mainline controlling both inhaul and outhaul. The term shotgun refers to the high speed that the carriage reaches while outhauling to a turn of logs. The skyline/carriage is then lowered to allow the logs to be choked for inhaul to the landing. This system provides good suspension or log lift to meet management objectives of partial or full suspension requirements. Maximum yarding distance is 1,500 to 2,000 feet uphill.

Slackline Systems

Slackline systems are a configuration of live skyline systems. A three-drum yarder (tower) includes a skyline, mainline, and a haulback for the inhaul/outhaul of a simple carriage with chokers attached. The main difference is that a haulback line rather than gravity is used to outhaul the carriage. Slackline systems provide excellent lifting capabilities and are employed when management objectives require full or large areas of partial suspension to avoid soil disturbance. Maximum yarding distance is 2,000 to 2,500 feet uphill or 1,000 feet downhill.

Standing Skyline (Long Span) Systems

Standing Skyline (long span) systems are similar to a live skyline system. Long-span skyline is the most common and has two main differences. The first is a non-moving skyline, and the second is the use of a radio-controlled carriage. A radio-controlled carriage is used with a two-drum yarder (large towers 90 feet or greater) which employs the use of a skyline and a mainline to support the carriage and to provide inhaul. The radio-controlled carriage has an internal engine which provides the pulling power to skid or inhaul the logs to it. Outhaul of the carriage is by gravity. Skidding line outhaul is controlled by radio; the carriage is stopped and clamped above a turn of logs where the skidding line is dropped to choke the logs. The carriage is then commanded to skid or inhaul the logs up to it where the yarder's mainline inhauls the carriage with the suspended logs to the yarder. This system is used when yarding distances of up to 5,000 feet are required. Shorter span versions of this system include the use of three-drum yarder-controlled carriage or a more simple falling block type carriage which utilizes a two-drum yarder. These include the North Bend (uphill yarding), South Bend (downhill yarding), and the multi-span system (uphill yarding). The multi-span system utilizes intermediate skyline support jacks similar to those found in ski lodge chair lifts. These enable the carriage to carry a load of logs over a topographic break in slope which would otherwise be a blind lead (the running and lift lines rubs the ground). These systems provide excellent lift and log suspension in areas that require full or partial suspension to meet management objectives.

Lateral Yarding Carriages

Carriages may be classified as slackpulling or non-slackpulling, and the slackpulling carriages may be further classified by how they accomplish the slackpulling function. Slackpulling carriages provide the skyline with lateral yarding capability and therefore can be used in a variety of silvicultural prescriptions. Non-slackpulling carriages can include either chokers or grapples and are used in clearcuts. For a skyline system to operate efficiently, the carriage must be matched to the number of lines and the line diameters on the yarder (Studier, 1993).

Slackpulling carriages are further broken down into manual slackpulling carriages where the skidding line is pulled through the carriage by hand, or mechanical slackpulling carriages which use either an internal carriage engine or the yarder to pay out the skidding line.

Yarder-controlled mechanical slackpulling carriages are more commonly used in harvest operations due to cost, weight, and flexibility. Two types of yarder-controlled mechanical slackpulling carriages include those like the Danebo MSP (Figure Silviculture and Timber-6), and the Danebo "S" series three drum carriage (Figure Silviculture and Timber-7).

Figure Silviculture and Timber-6
Yarder-Controlled Mechanical Slackpulling Carriage—Danebo MSP

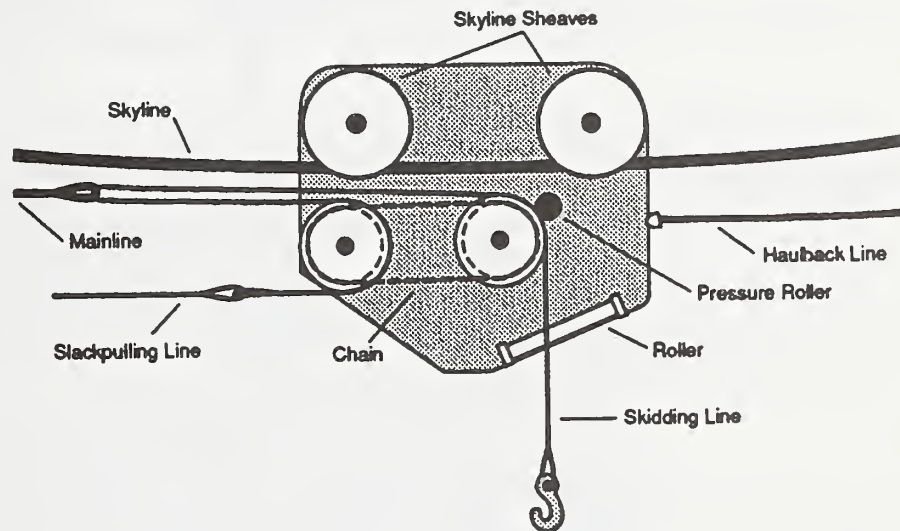
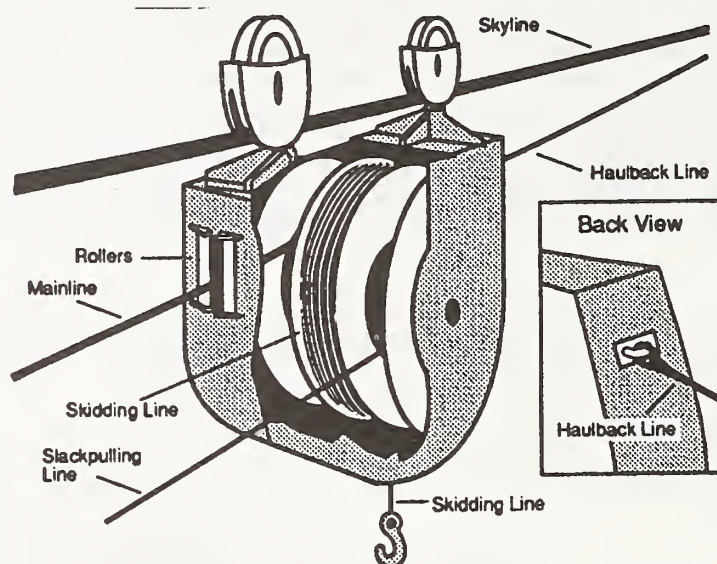


Figure Silviculture and Timber-7

Yarder-Controlled Mechanical Slackpulling Carriage—Danebo "S" Series Three-Drum Carriage



Helicopter Yarding

Helicopter yarding is proposed in all alternatives. Helicopter yarding has been successfully used on all areas of the Tongass National Forest within recent years. On the Ketchikan Administrative Area, Revilla Island, large portions of the North Revilla Project Area are currently being helicopter yarded. Portions of the Upper Carroll Timber Sale are also planned for helicopter yarding. With this system, logs are lifted off the ground (fully suspended) and flown to a specially prepared landing. This yarding system causes the least amount of ground disturbance of all the yarding systems, but has the highest yarding cost.

Helicopter yarding, as a rule of thumb, is commonly three times or more expensive than conventional cable systems logging. When analyzing economic efficiencies between the cost differences of helicopter and conventional yarding systems, the cost of road building must be assessed against the increased cost of helicopter yarding. Cost may not be the main deciding factor in logging systems design, as resource protection measures often mandate the use of helicopter yarding (full suspension) to meet standards and guidelines.

The economic feasibility of helicopter yarding is more closely affected by market values than cable yarding. Maximum yarding distance is regulated by economics. Helicopter flight time costs between \$2,000 and \$5,000 per hour. Maximum flight time between loads or turns of logs is approximately three minutes. Factors that affect flight time and economic feasibility include elevational differences between stump and landing, number of logs or volume per acre, species mix and subsequent value, and payload capabilities of the aircraft.

Effects of Proposed Yarding Systems

All yarding proposed is in conformance with National and Regional Standards and Guidelines. Yarding systems were assigned to settings in an interdisciplinary process after extensive field reconnaissance to minimize any potential or unforeseen effects. On-site ground reconnaissance and actual field evaluations during the layout and harvest process will ensure the designed yarding system will provide the required suspension to meet management objectives as specified by reviewing specialists. For effects analysis see the Ecological Landtypes section of this chapter.

Reserve Tree Selection Guidelines

In 1993, a committee was formed that included members from the Wood Products Industry, the Forest Service, and the Alaska Department of Labor, Occupational Safety and Health Administration (OSHA), to develop guidelines in the selection of reserve trees. Their main objective was to provide a technical framework to achieve safer working practices in concert with forest and wildlife management goals. The Reserve Tree Selection Guidelines booklet (USDA, Forest Service, Alaska Region R10-MB-215, March 1993) is dedicated to the principal that no worker shall be exposed to a danger tree.

These guidelines are used in both the Sea Level planning process as well as during the layout process for project implementation. The reserve tree selection criteria process, described in the Silviculture part of this section, use many the technical guidelines recommended by the committee.

Elements of successful reserve tree planning include definitions and strategies for selecting reserve trees that are compatible with safe, modern forest practices. Long-range planning on a large scale allows more design options for safe ways to reserve trees for meeting wildlife needs.

The arrangement of reserve trees is key to meeting distribution objectives in a manner compatible with safe work practices. Uniform distribution of reserve trees on every acre is not necessary. Reserve trees can be retained along yarding breaks or clumped within the unit to accommodate operational needs. Reserve-tree retention on excessively steep slopes (greater than 72 percent) is not always feasible due to limited falling corridors during the cutting stage of the harvest process. Long-range plans should provide criteria for tree selection and distribution that are flexible enough to account for ongoing tree decay processes and changes in harvest plans. Many of the difficulties in retaining reserve trees during harvest can be eliminated through careful site evaluation, considering the specific abilities of harvest equipment and processes, and implementation in both the planning and layout process.

Operational Guidelines

Cable Yarding

The type of yarding system and topography will determine where reserve trees can be safely retained. As a general rule, harvest systems capable of using a slack-pulling carriage are the most able to retain trees within the unit and systems. Systems with no lateral yarding capability and down-hill yarding usually require that reserve clumps, groups, and individual trees be left only along the edges of settings.

Systems with Lateral Yarding Capability

In uphill yarding with lateral yarding capability (slackpulling carriages), individual trees, clumps, and groups may be left in mid-setting. To suspend logs over or yard through the reserve areas can only be done if there is sufficient deflection (operating lines must not be within hazard areas, see Reserve Tree Selection Guidelines).

Helicopter Yarding

Helicopter logging allows flexibility to leave reserve trees nearly anywhere in the unit because it can access logs from various directions. However, it creates special problems with rotor down-wash, such as flying limbs and chunks. Logs swinging against standing trees

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during log pick up may also dislodge portions of reserve trees. The hazard area may need to be enlarged to address this increased hazard.

Timber Economics Efficiency Analysis

Current Forest Service Handbook direction FSH 2409.18—Sale Preparation Handbook, WO Amendment 2409.18-95-1, 2, 3, and 4 and further described in the R-10 Supplement No. 2409.18-93-3 requires an economic efficiency analysis to compare benefits and costs of a project. Values used in the analysis must reflect midmarket timber value estimates that are based on median or mid-level timber market values. In order to account for market fluctuations, weighted average timber values over the past 10 years are used in this analysis.

Forest Service Handbook (FSH) direction also provides for including an allowance for at least 60 percent of normal profit, which must be included when calculating costs and returns. This economic-efficiency analysis is performed by comparing expected gross revenues against estimated costs and arriving at an estimate of net revenues.

Pond Log Values

Pond log values represent the delivered price of logs at the mill minus the cost to manufacture them into usable products. On the Ketchikan Area, the lower volume classes generally have a higher yellowcedar component, which has the highest selling value. On the Project Area, this sometimes results in a high pond log value for the lower volume classes. For this analysis, pond log values reflect lower chip manufacturing costs, rather than higher pulp manufacturing costs, due primarily to the recent closure of pulp manufacturing facilities in Southeast Alaska. The stumpage value does not include bid premiums that would result from competitive bidding for the timber when sold. It should also be noted that chip (or other value-added products) values have not been added into the pond log values. In an actual appraisal, each timber sale would add an appropriate chip value to the value per MBF. Recent appraisals have indicated this value is approximately \$100 to \$200 per MBF.



Yarding Costs and Pond Log Values

Stump-to-truck logging costs are subtracted from the pond log values to arrive at a delivered price to the mill. Stump-to-truck logging costs include felling, bucking, yarding, loading, and administrative costs. Logging costs are closely tied to volume per acre (represented by volume class data). Generally, the higher the volume per acre the lower the logging cost. Table Silviculture and Timber-14 shows the stump-to-truck logging costs.

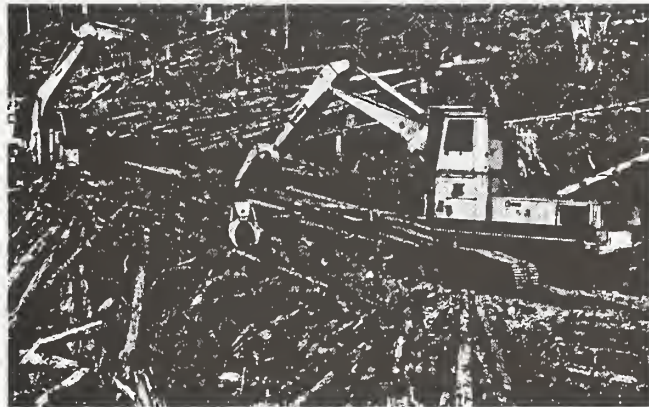
Table Silviculture and Timber-14
Summary of Yarding Costs by System (Dollar Amount per MBF)*

System	Dollar Amount per MBF
Skyline - Running	67.12
Skyline - Live	50.51
Slackline	78.59
Shovel	50.52
Helicopter **	175.50

Source: Fletcher 1998

* Logging system costs/MBF were adjusted for the analysis to reflect site specific conditions per alternative.

** Range of helicopter costs are based on area averages adjusted to R10 costs. Actual helicopter yarding costs by alternative are based on averages from previous timber sales. These costs are used for midmarket analysis.



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Additional Costs that Affect Timber Sale Economics

In addition to stump to truck logging costs, other costs (i.e., watering, rafting, tow, specified road construction and reconstruction, temporary road construction, LTF construction, camp development, and helicopter support) need to be considered when determining the economics of timber sales. For the purposes of this analysis these costs were included in total logging costs. Midmarket costs are summarized by alternative. Because Alternative 1 does not propose any timber harvest, it is not displayed in the table.

Table Silviculture and Timber-15
Pond Log Values per MBF, by Alternative.

	Alternative (Dollar Amount per MBF)		
	2	5	7
Total Volume (MBF)	77,229	22,163	50,886
Pond Log Value Per MBF (Low Market) ^{1/3}	\$189.89	\$186.10	\$191.76
Pond Log Value Per MBF (High Market) ^{1/3}	\$521.00	\$521.00	\$521.00
Pond Log Value Per MBF (MidMarket) ^{1/3}	\$512.47	\$525.09	\$519.75
Direct Costs plus Profit and Risk ²	\$426.82	\$453.54	\$428.55
Net Stumpage Value/Per MBF (Low Market) ⁴	(\$236.93)	(\$267.44)	(\$236.79)
Net Stumpage Value/Per MBF (High Market) ⁴	\$94.18	\$67.46	\$92.45
Net Stumpage Value/Per MBF (MidMarket) ⁴	85.65	71.55	91.20

¹ Pond log values: Low market is based on the current market appraisal; high market is based on 1st quarter 1995 values and average Forest-wide species composition; midmarket is based on the weighted process following Forest Service handbook direction as described in the paragraphs above.

² Direct Costs = Total logging and total transportation costs

³ Does not include chip values (approximately \$100-200/MBF)

⁴ Net Stumpage Value = Pond log value - Total direct costs - 60% profit margin.

Source: Fletcher 1998

The implications of Table Silviculture and Timber-15 are summarized below:

- Logging cost per MBF is highest for Alternative 5 (\$453.54). This alternative requires a substantial amount of road construction to access the relatively lesser amount of volume which results in higher construction and transportation costs per MBF .
- Conversely, average cost per MBF is lowest for Alternative 2 (\$426.82) because the greater proposed volume will offset incurred transportation and construction cost. Overall, Alternative 2 would increase the Area's ability to offset the cost of harvesting the more difficult and isolated components (see Operability, this section).
- In addition, transportation and harvest cost are not offset due to lower volumes.
- Average helicopter costs were derived from using adjacent sale area averages. Helicopter yarding cost per harvest unit is based on the following: unit elevation,

landing elevation, type of aircraft, and stand data (volumes, stems per acre, pounds per board foot, etc.). Helicopter payloads and flight distances (flight time) are adjusted by the various input factors to produce the end result of unit yarding days which is further refined to total cost per unit. Unit yarding costs are further adjusted to R10 requirements.

Comparison of Alternatives Based on Estimated Net Midmarket Values

Estimated net timber value is arrived at by subtracting all associated costs from the pond value for all proposed harvest units in each action alternative. Consequently, individual units which may be uneconomical to harvest by themselves are offset by combining them with other units which are more economical to harvest. This results in less productive land or land where the timber is highly defective being made more economically viable for timber harvest. These lands are then brought under management, thereby increasing future timber yields, and postponing entry into more environmentally sensitive areas.

These projected construction costs, transportation costs, and pond log values are estimates, not actual costs, which form a constant by which all alternatives may be compared. Before the timber is sold, the volume within the units and ROWs will be cruised and appraised to determine the actual volume and value of the timber. Because all action alternatives are measured against the same yardstick of estimated costs, it is appropriate to rank the alternatives in order by net value. Table Silviculture and Timber-16 shows the estimated value (based on midmarket analysis) and ranking of each alternative based upon the net value. Net values are shown rounded, since the figures are based on estimates. Because Alternative 1 has no timber harvest costs or values, it is not listed.

Table Silviculture and Timber-16
Estimated Stumpage Values (\$/MBF) by Alternative Volume (MBF) Based on Midmarket Analysis

Alternative	Estimated Total Volume	Total Pond Value*	Total Logging Costs**	Total Road. Costs***	Total Production Costs and P & R****	Estimated Net Value @ Mid Market	Rank Order
2	77,229	512.47	385.81	153.19	467.82	6,614,664	1
5	22,163	525.09	415.43	185.05	453.54	1,585,762	3
7	50,884	519.75	388.24	160.90	428.55	4,645,621	2

Source: Fletcher, Oien 1998.

* Values are for comparative purposes only.

** Logging costs include all costs normally connected to logging, such as: fall, buck, yard, sort, water tow, spur road construction.

*** Road costs include costs associated with road construction and reconstruction, such as: pit development, clearing, grubbing, embankment, haul, excavation, and related material, bridges and culverts.

**** P & R refers to Profit and Risk of 60 percent.

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Based on this analysis all midmarket values for each alternative show positive net stumpage rates. Costs for temporary road construction and specified road reconstruction may fluctuate when updated for the offering appraisal. Changes in logging costs and selling values can also have an undetermined effect on overall stumpage values; changes in these values will not alter the economic ranking of alternatives because they are applied equally to all alternatives. Only modification of an alternative(s) will alter economic ranking.

The economic efficiency assessment indicates all alternatives could be sold in higher market conditions, as the current market indicates none of the alternatives would show positive net stumpage. This reflects that the current market is at an extreme low in the market cycle and the 1995 (High Market) shows that the market would be likely to cycle upwards within the life of this project.

Partial-cutting prescriptions, helicopter logging, and areas with high development costs create economic risk. Partial-cutting prescriptions can reduce the economic efficiency of the yarding operations by increasing the yarding costs and reducing the overall stumpage available to pay for the cost of the operations.

Helicopter logging is used to harvest areas that cannot be economically roaded, or cannot be roaded because of unacceptable effects on resources such as soil and water protection. Some stands of timber with heavy partial-cutting prescriptions require a helicopter to yard because conventional systems cannot implement the prescriptions and meet stand resource objectives.



Socioeconomic Environment

Key Terms

Direct effects for employment and income—represents the response or change in a given industry due to a change in the final demand for that industry, changes that occur within the industry of interest. An example of direct effects in the wood products industry would be a change in the number of people employed in a sawmill due to an increase in wood available to the sawmill.

Discounted benefits and costs—the sum of all monetary or assigned benefits and costs derived from the Forest over the life of a project in current dollars. This is a measure of all expected costs and benefits of a project, accounting for inflation.

Economic efficiency—a measure of the relationship between discounted costs and discounted benefits, such as present net value or benefit/cost ratio. These measures allow different management alternatives to be compared in terms of long term returns of public benefits.

Indirect effects for employment and income—represents the response by all local industries to a change in activity by a direct purchasing industry, changes in a business which provides goods and services to a directly impacted sector. An example of indirect employment would be changes in the employment at a sawmill servicing business due to changes in the amount of wood available to the sawmill that requires services.

Induced effects for employment and income—represents the response of all local industries to a change in household spending. An example of induced effects in employment would be grocery store employees who sell products to people working in a sawmill or sawmill servicing business.

Pond log value—price of delivered logs at mill minus manufacturing costs.

Present net value (PNV)—the difference between discounted benefits and costs associated with different management alternatives. This is a measure used to compare the economic efficiency of the alternatives.

Primary zone of influence—the area where social, economic, and/or environmental conditions are significantly affected by changes in forest resource management and outputs. Also referred to as the study area.

Public net benefits (PNB)—the sum of the present net value and nonpriced commodities (such as scenic quality and community stability) of each alternative. This is a measure of economic efficiency used to compare alternatives.

Affected Environment

This section provides a baseline for evaluating the economic and social condition of the Sea Level Project Area. Included is a discussion of regional and local employment and income, returns to the federal treasury, payments to the state, economic efficiency, sales below cost, nonmarket values and nonpriced values. The following section is an analysis and comparison of the potential and cumulative effects that could result from implementing a Project alternative.

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Employment and Income

The primary zone of influence for the purpose of this economic analysis is the region around Ketchikan. This area consists of the Ketchikan Gateway Borough, which includes the city of Ketchikan, Saxman, Ward Cove, and Gravina Island.

The economy of Southeast Alaska is diverse, but with over 90 percent of the region managed by the Forest Service, much of the economic activity is resource-based. This would include not only resource-use industries such as wood products, salmon harvesting and processing, and mining, but also non-use resource industries including recreation and tourism. A more complete analysis of the regional economic situation is discussed in the TLMP Final EIS, Part 2: chapter 3.

The economy within the study area is one of the more diverse in the region. It continues to support a large wood products industry after the closure of the Ketchikan Pulp Company's (KPC) pulp mill in Ward Cove. Recent wood product industry developments include KPC, one of Ketchikan's largest employers, plans to open a veneer mill in addition to the small log sawmill located at Ward Cove and Steve Seley's Lewis Reef project, which will feature a sawmill with several value-added sections including a planing and molding division. Tourism and other service industries have continued to expand as the number of people visiting Southeast Alaska grows. Other industries, including transportation, communication, retail and educational services, health and social services, and government are also a significant part of the study area's economy. For a complete analysis of the Ketchikan Gateway Borough economic situation, refer to the TLMP Final EIS (1997).

Industry and individuals throughout Southeast Alaska have an interest in how the Forest will be managed. Within the study area, interest in Forest management includes a mixture of local economic concerns and quality of life/life-style issues. Many of the area residents derive their incomes from economic activity in their communities, but they also value the recreational and aesthetic opportunities that are present in the vicinity. While the livelihood of some people may depend indirectly upon the forest, others also have an important stake in its management, both for short-term economic considerations and for the maintenance of their current life-styles.

The following sections describe trends and current situations of the three major resource industries related to Forest management, wood products, salmon harvesting and processing, and recreation and tourism. For more information concerning these industries, refer to the TLMP Final EIS (1997).

Wood Products Industry

The activity of the timber industry mirrors that of the Pacific Northwest where a global recession in the wood products industry and depressed output in the early to mid 1980s was followed by a boom and then subsequent declines in timber harvest, in spite of rising prices, due to supply constraints. The variable activity is striking but not all that unusual for an industry, such as the wood products sector, which is prone to "boom and bust" cycles.

Current timber harvest statistics for Southeast Alaska and the Tongass National Forest are provided in *Timber Supply and Demand* 1996 (USFS R10-MB-357). Total Southeast timber harvest levels range from 457 MMBF in 1984 and 1996 to peak levels of just under 1,000 MMBF in 1989 and 1990, with an average over the 1981-96 time period of 671 MMBF.

The vast majority of the region's timber harvest comes from two sources: (1) the Tongass National Forest and (2) Private land. On average, over a ten-year period, 1985 to 1996, these two ownerships accounted for 43 percent and 55 percent respectively, with private harvest exceeding Tongass National Forest harvest by an average of 14 percent. Private lands are not subject to Federal requirements for primary manufacturing that restricts the export of most logs from the Tongass National Forest. Most private timber harvest is exported overseas without processing for higher prices than processed logs would bring. Because local mills are

unable to compete with overseas market for the wood supply from private lands, the timber harvest from the Tongass National Forest has a significant link to local employment and income in Southeast communities.

On average, over the 1981-96 period, logging employment accounted for about half of total sector direct employment. Pulp production and sawmills accounted for 31 and 17 percent respectively (1996 TLMP revision, and TLMP 1997). Although with the closure of the KPC pulp mill, it is uncertain as of yet what will happen to future utility logs and sawmill waste, employment will change based on future developments around the pulp resource. Past employment patterns follow the generally familiar depressed levels of the 1980s, followed by a peak in 1990 and subsequent decline, but the variation is somewhat less than in the harvest or production statistics. Delays in employment response to decreased production are common and further declines in employment levels can be expected even if 1996 harvest levels are maintained.

Because most of Alaska's forest products are exported, fluctuations in wood product markets are primarily a function of international markets and do not necessarily reflect domestic markets alone. A constant supply of Tongass National Forest wood is not the only factor controlling timber employment. Other controlling factors include foreign exchange rates, the overall Pacific Rim demand for wood products, and competition among timber suppliers outside the Tongass National Forest. For an in-depth discussion of wood products supply and demand of Southeast Alaska, see the TLMP (1997) Part 2, pg 3-449 to 3-452.

Commercial Fishing Industry

Harvesting and processing of fisheries resources provides a broad base of employment opportunities throughout Southeast Alaska. Many small towns and villages are economically dependent on seafood harvest and processing. The Ketchikan Area supports diverse seafood based employment opportunities for bottom fish, herring, shellfish, salmon, and other specialty products. The seafood industry is highly seasonal. The potential for year-round employment is enhanced with the diversity of harvestable species, harvest methodology (troll, seine, longline, trawl, etc.), and the processing methodology (frozen, canned, and the fresh market). Expansion of the bottom-fish sector provides the greatest opportunity for increased employment and more year-round employment opportunities (Alaska Department of Labor, Research and Analysis 1990).

Recreation and Tourism

During the 1980s, the tourism industry became a major force in the economics of Southeast Alaska. Resident recreation is also increasing as local populations grow with people moving to Southeast to enjoy the life-style not readily found in the lower-48. Both residents and tourist spend their money in the local economy for goods and services that assist their enjoyment of the environment. Increases in resident recreation can be most visibly seen in the increases in hunting and fishing license sales and equipment.

Cruise ships are traveling the Inside Passage, making regular stops at Southeast Alaska ports in record numbers. Newer and larger capacity ships are bringing more and more people to Alaska at an economical price. Smaller ships, tailoring to people interested in a more intimate, eco-tourism experience, have also found a niche in the Southeast tourist industry. These types of innovations are increasing the numbers of visitors and types of activities that make up tourism in Southeast. The visitor season currently runs from May through September. Cruise ship passengers visiting Ketchikan have grown from 85,000 passengers in 1981, to 426,232 passengers in 1996, with State ferry activity showing similar growth patterns.

Marketing studies by the Alaska Division of Tourism indicate that scenery, forest, mountains, out-of-doors, and wilderness (unspoiled, rugged) were the top interests which appealed to potential nonresident visitors (Bright 1985). Tourism is currently one of the top three

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industries in Alaska, and though it is dependent on seasonal labor associated with low wages, sectors of the industry are establishing themselves as year-round and well-paid.

Sport Fishing

The Southeast Alaska Sport Fishing Economic Study (1991), a research report done for the State of Alaska, contains Ketchikan Area information:

"In 1988, anglers spent \$83.1 million for sport fishing in Southeast Alaska. Resident anglers spent about \$40.7 million and nonresident anglers spent about \$42.4 million. Ketchikan area resident anglers spent about \$6.6 million on sport fishing. For nonresident anglers, sport fishing in the Ketchikan area generated the most spending, comprising about \$13.7 million, or 32 percent of all nonresident angler spending."

Of all species sought by residents and nonresidents, king salmon generated the most spending, accounting for \$13.3 million, or about 32 percent of all resident angler spending, and \$9.6 million, or 23 percent of all nonresident spending. This has important significance for the local sport fishing charter fleet.

It was estimated that in 1988, angler spending generated \$1.5 million in local sales tax revenue, \$105,000 in lodging tax, \$135,000 in state corporate income tax, and \$1.2 million in fishing license revenues. For nonresident anglers, fisheries in the Ketchikan Area are the most valued throughout Southeast Alaska, with an annual "willingness-to-pay" value of \$7.5 million. The *willingness-to-pay* concept can be described as a value which approximates market price or the amount a consumer is willing to pay for a product.

Sport Hunting

In Southeast Alaska and the Ketchikan area the primary big game species, in terms of number harvested and hunter participation, is the Sitka black-tailed deer. Deer constitute over 90 percent of the total big game harvest in Southeast Alaska (Doerr & Sigman 1986). Estimating value using the willingness-to-pay concept, resident Southeast Alaskans would pay \$332 (Swanson, Thomas, and Donnelly 1989). Hunting expenditures were not available for the Ketchikan Area.

Employment and Income for Primary Zone of Influence

Forest Service resource use and management supports employment and income opportunities throughout the Southeast region. It is difficult to determine the exact number of jobs associated with only Forest Service output because other lands and agencies also provide opportunities for local businesses to operate. The following Socioeconomic Table-1 reflects the number of jobs associated with the major resource-related industries within the study area. These figures are inclusive of all resource production within the study area, not just that associated with Forest Service management.

Table Socioeconomic-1
Employment and Earnings for Three Major Industries in Southeast Alaska, 1995

Industry	Direct Employment	Indirect Employment	Total Industry Employment	1995 Average Annual Earnings	Direct Earnings (millions)	Total Industry Earnings
Wood Products	2,070	1,514	3,584	\$44,542	\$92	\$160
Commercial Fishing	3,503	2,295	5,798	\$26,246	\$92	\$153
Recreation and Tourism	2,941	947	3,888	\$31,773	\$93	\$124

Source: TLMP, 1997.

Notes: Employment includes all part- and full-time people and accounts for residents and nonresidents. Earnings are in 1995 dollars.

Returns to the Federal Treasury

Management of the United States National Forest system generates revenue for the Federal Treasury. Revenue returns from the Tongass National Forest fluctuate from year to year. Returns were \$45 million in 1987, and \$34 million in 1994. Timber sales are the source of about 99 percent of federal receipts for this area; fees from recreation permits, admissions, and user fees make up the other 1 percent.

Payments to State

Revenue from National Forest timber sales are shared with State and local governments. Twenty five percent of the total revenues received by the National Forests are returned to State and local governments to support schools and roads. Payments to the State of Alaska from the Ketchikan Administrative Area (including purchaser road credits) ranged from \$3.2 million in 1992, to \$8.7 million in 1994 (\$388,314 went to the Ketchikan Gateway Borough). The Ketchikan Gateway Borough has historically been allocated 4.46 percent of the total Tongass payments to the State, which the Borough has used to supplement road and school budgets. Changes in these payments are of considerable interest to local residents.

Economic Efficiency

The National Forest Management Act of 1976 (NFMA) set requirements for economic efficiency of forest management proposals. Although the Forest Service has generally tried to achieve cost-effective management (lowest possible input cost per unit of output), systematic evaluation of all costs and benefits from forest management practices and activities has been undertaken only in recent years.

The harvesting of timber involves large investments. The economic efficiency of these investments is relevant to the choice of different alternatives being considered. This issue is addressed in three ways:

1. The economic efficiency of alternatives will be evaluated. Historic costs for managing, harvesting, and processing timber, and historic prices for various timber and wood products are identified and the present net value (PNV) of each alternative is estimated.
2. Below-cost timber sales will be evaluated.
3. Other nonmarket and nonpriced values are evaluated and discussed. Many of these values are nonquantifiable within the scope of this project and, therefore, are assessed in a qualitative way.

For a comprehensive analysis, these factors must be considered along with the timber economics to determine the net benefit to the government from timber harvest.

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The measure of economic efficiency applied in formulating and evaluating alternatives is public net benefits (PNB) (see Key Terms) (36 CFR 219.1(a) and 219.12(f)). Examples of nonpriced benefits include scenic quality, wildlife habitat, and community stability. Public net value is a method of adjusting revenues and costs to allow their comparison over time. Values of some nonpriced commodities are inferred from observations such as the number of participants, tolerance of congestion, and expense of participation.

Sales Below Cost

In response to concerns about the costs and revenues from timber sales on National Forest lands, especially sales where costs exceeded revenues, the General Accounting Office (GAO) and the Forest Service, at the direction of Congress, jointly developed the Timber Sale Program Information Reporting System (TSPIRS). TSPIRS reports are designed to describe financial aspects of the forest-wide timber sale program. Managing timber is a long-term commitment of land and resources with a variety of activities occurring each year at various ages in stand rotation. For this reason, many forest management costs, such as roads and reforestation, are pooled and then redistributed over a series of years based on the amount of timber harvested. This is a different approach than is used in the calculation of PNB described above where costs are measured in the year they occur and discounted back to the present.

Large development costs usually accompany new timber sales. These costs in turn translate into revenue for local businesses and employment and income for local people. The TSPIRS reports provide a description of the extent of investments in timber harvesting on the Tongass National Forest. In 1994, on the Tongass National Forest expenses exceed revenues by \$300,000. Revenues were over \$123 per MBF while total controllable expenses were about \$124 per MBF (includes payments to the State of \$4.83 per MBF). There was a total net loss of about -\$1.10 per MBF (Page 60, 1994 TSPIRS Report).

Nonmarket Values

A discussion of the relationship between an economic benefit to cost analysis and the analysis of unquantified environmental effects, values, and amenities is useful in considering project alternatives. In Forest Service terminology, three types of values are typically considered in economic evaluations: market values, nonmarket values, and nonpriced values. Market values are those established through a market, such as timber. Nonmarket values are those that can be quantified using economic techniques that infer or deduce values which might prevail if a market were present, such as some types of recreation. These first two types are included directly in the benefit to cost analysis. Nonpriced values refer to those for which it is impossible to quantify a value, even with nonmarket economic techniques, such as the value of religious sites or genetic diversity.

Nonmarket values such as recreation, fish, and wildlife are not typically established by a market but are important considerations in making resource management decisions. Wildlife viewing and photography are some of the most popular activities among forest visitors. A survey of businesses which provide products and services for wildlife viewing, wildlife photography, and other nonconsumptive wildlife uses indicated that this use is rapidly increasing in Southeast Alaska (Shea 1990). It is estimated that over 200 businesses in Southeast Alaska provide wildlife viewing recreation services. This business activity is growing as much as 33 percent annually, with client expenditures contributing substantially to the economy (Shea 1990). Nonmarket values can be applied to changes in the levels of some recreation, fishing, and hunting activities associated with the alternatives to estimate the economic value of these changes.

Nonpriced Values

There are many values (nonpriced values) that people hold, for which markets do not exist and to which market values cannot be attached. Among others, these include active-use values (subsistence), the value of the forest as habitat for wildlife, and passive-use values. Passive-use values include existence, option, and other nonuse values (Mitchell and Carson 1989). They represent values of people who may never visit the Project Area, but benefit from the knowledge that the area exists in a certain condition. This value can be

intergenerational since timber cuts conducted in the 1990s, will be visible for the next human generation. Recent work in this field was conducted following the Exxon Valdez oil spill in Prince William Sound, Alaska.

Some important nonpriced values are visual quality, diversity and quality of recreation opportunities, old-growth retention, suitable habitat for threatened and endangered species, and cultural resources. Another is the value of retaining old-growth forest and wilderness or semi-wilderness areas.

Quantitative surveys to determine prices for values based on people's willingness-to-pay (such as to avoid habitat degradation) must be conducted on a national or international basis. They are beyond the scope of this project and have not been conducted for the Tongass National Forest as a whole. It should be noted that contingent values can be quite high. Those arrived at for the oil spill study determined that the people of the United States were willing to pay about \$3 billion to avoid the oil spill (Carson et al. 1992). It is evident that similar values exist for the Tongass National Forest because of the concern expressed by the general public and some conservation and preservation organizations about logging on the Tongass National Forest and the response to those pressures by Congress.

Judgments are necessary in assessing whether the benefits of maintaining nonpriced values equal or exceed the trade-offs of producing priced values. While the quantitative dollar values of nonpriced values cannot be determined, they generally can be examined by association with such quantitative indicators as acres, resource inventories, or timber production related activities and outputs.

Effects of the Alternatives

Employment and Income

Employment and Income Levels

Multipliers generated by a Forest Service input-output economic model were used to estimate employment and income supported by each alternative within the Sea Level Project Area. The multipliers used included direct, indirect, and induced impacts to the economy. In this way, the multiplier traces money as it cycles through the study area. The cycle starts with the direct impacts of the wood products industry; the multiplier accounts for all employment and income associated with additional activity in the wood products sector. Indirect impacts are then accounted for as those businesses that support the wood products industry change their employment and income based on the activity of the wood products sector. Finally, induced impacts are accounted for as businesses that serve the people who are employed within the wood products and supporting industries. These impacts, or ripples, are all accounted for within the study area as a single multiplier. So, the larger the original impact, in this case, a timber sale measured in MMBF, the more money that will ripple through the community, creating a larger total impact. These jobs and income would be in addition to the jobs and income already supported by the community's economy. It is assumed in this analysis that these additional jobs will be within the study area, when in reality it is difficult to predict what business, if any, will take advantage of resource opportunities. Socioeconomic Table-2 displays the results derived from the multiplier analysis for each alternative.

Timber Industry

Each alternative will affect the number and composition of timber-related employment within the communities in the primary zone of influence. The amount of timber offered for sale within the Project Area is not the only factor that affects the number of wood products industry jobs. Other factors may include the supply and demand for wood products and the subsequent number of employment opportunities, worker productivity, interest rates, import and export levels, production and shipping costs, competition, and other landowner harvest levels and policies.

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Segments of the wood product industry which would likely be affected by the Sea Level Project include sale of logs, cants, dimension lumber, and wood chips.

Table Socioeconomic-2
Projected Wood Product-Related Additional Jobs and Income by Alternative *

Harvest	Alternative							
	1		2		5		7	
	Jobs	Income	Jobs	Income	Jobs	Income	Jobs	Income
Logging	0	0	150	6.46	43	1.84	99	4.28
Construction	0	0	133	5.70	38	1.62	15	0.66
Marine Transport	0	0	6	0.30	2	0.07	1	0.03
Subtotal	0	0	289	12.46	83	3.53	115	4.97
Sawmills	0	0	194	8.33	55	2.38	128	5.52
Total	0	0	483	20.79	138	5.91	243	10.49

Source: Marks 1998.

*Number of jobs and income is calculated by alternative volume estimates only. Calculations include ROW volume

Jobs = Direct Jobs (person years) 1992 IMPLAN MODEL

Income = Direct Income (millions of dollars) 1992 IMPLAN MODEL

Alternative 1 proposes no timber harvest and could result in a decline in timber-related employment should the local mills not be able to substitute volume from another source. The effects of Alternative 1 are not predictable and could range from elimination of shifts to a partial or even a full short-term shutdown of a mill in addition to the potential loss of revenue.

Employment opportunities closely parallel the level of timber harvest. A larger timber harvest is accompanied by greater local expenditures. Therefore, Alternative 2 produces the highest impacts, since local expenditures associated with its implementation are highest among the alternatives. The annual harvest and annual mill production under Alternative 2 would result in the largest employment gains associated with the harvest; harvest under the scenarios proposed for Alternatives 5 and 7 would sustain a lower level, about half of the regional employment relative to Alternative 2. As employment is reduced, regional income and economic output would fall as well.

Long-term impacts on timber employment on the Ketchikan Administrative Area are a function of the Forest Plan, and the analysis in the TLMP Final EIS (1997) is incorporated by reference. The primary effect of any of the action alternatives would, however, be maintenance of current employment levels.

Commercial Salmon Fishing Industry

Current standards and guidelines and management area prescriptions are expected to limit measurable effects on salmon during timber harvest and related activities. There are no substantive changes in commercial salmon habitat capability predicted. The direct and indirect jobs attributable to National Forest System lands for the commercial salmon industry should also remain unchanged for all alternatives. Again, the TLMP Final EIS (1997) can be referred to for further discussion of the impacts to commercial salmon fishing.

Recreation and Tourism

Projections for future employment for Southeast Alaska in the recreation and tourism industries, including employment related to sport hunting and fishing, are a 27 percent increase for recreation and tourism, 36 percent for sport fishing, and 53 percent for hunting related jobs during the 1990s, (TLMP Final EIS 1997). The core community of Ketchikan should, on the average, reflect these increases. Differences between action alternatives should have little overall impact on these projections.

The action alternatives will have no measurable effects on sport fishing jobs. The action alternatives are expected to have no measurable effects on jobs generated by permits for kayak or air charter services due to set standards and guidelines for visual resources. There are no outfitter/guides with current permits or waivers operating within the Sea Level Project Area.

Access to the area by plane will remain unchanged. However, access by foot travel and All Terrain Vehicles (ATV) will increase with implementation of action alternatives. Past experiences in adjacent project areas show an increase in sport fishing and hunting due to having a developed LTF and docking facility with a connecting road system. Even though roads are often closed to vehicle traffic, hunters will often boat to LTFs and gain access to a project area by utilizing the road system. ATVs are often used if main roads remain open.

A TSPIRS analysis depicting Federal returns for the Sea Level Draft EIS was considered but not performed. TSPIRS was designed to be assessed on an annual basis at the National Forest level for the timber program as a whole, with expenses and costs amortized over the length of the entire rotation (100 years). Furthermore, TSPIRS sums all expenses associated with a timber sale including NEPA prep work, timber inventories, etc. These expenses are then put into a sale or growth activity pool and a percentage is subtracted each year based on how much volume is harvested versus how much remains under contract. Tracking annual project expenses from planning through implementation and final harvest spans several years and is difficult to track on a project-by-project basis (R. Zaborske, Regional Office Direction, 1993). The estimated costs and profits analysis under Economic Efficiency within this section more accurately portrays actual returns to the Federal Treasury.

Returns to the Federal Treasury

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Payments to the State

Socioeconomic Table-3 displays the estimated volume of timber harvested, anticipated total timber receipts, estimated returns to the State (includes purchaser road credits) and Borough, and total estimated net revenue to the United States Government. These estimated returns could be dispersed over a 3 to 7 year period depending on the rate of timber harvest. The anticipated total timber receipts for all alternatives are displayed for the total Project Area which includes the LTFs located at Shelter Cove, Shoal Cove, and Elf Point.

Returns to Ketchikan Gateway Borough reflect historical payments of 4.46 percent of the total Tongass returns.

Table Socioeconomic-3
Estimated Returns to State of Alaska and Ketchikan Gateway Borough

	Alternative			
	1	2	5	7
Estimated Total Volume (MMBF) ¹	0	77	22	51
Estimated Total Returns to U.S. Treasury (\$) ²	0	6,614,664	1,585,763	4,640,621
Estimated Returns to State (\$) ³	0	4,611,344	1,421,756	3,206,964
Estimated Returns to KGB (\$)	0	205,666	63,410	143,031

Source: Fletcher 1998.

1 Rounded to the nearest MMBF including right-of-way.

2 Based on midmarket rates (does not include possible bid premiums or purchaser road credit values).

3 25% of estimated total anticipated receipts (includes purchaser road credit value and base rate value).

Economic Efficiency

Historically, the timber market has been cyclic, with sharp peaks and valleys in pond log values. A modest change of a few dollars per thousand board feet can result in significant shifts in the economic supply of timber. The present net value yardstick reflects historical average conditions for both prices and costs, and may not represent the economic viability of the Project Area in any given year.

Midmarket Analysis

Table Socioeconomic-4 summarizes the differences in approximate net stumpage value between alternatives. The stumpage values represents the economic efficiency of each alternative. Each alternative has a specific management strategy or emphasis which requires certain timber harvest levels that may not be the most economically efficient harvest pattern for the Project Area. The management strategy for Alternative 3 is for maximum economic efficiency. With the relatively low amount of cedar and associated low pond log values, the logging costs are not offset completely. Negative net stumpage values indicate that the direct costs associated with timber harvest exceeded the direct value of the benefits.

Table Socioeconomic-4
Summary of Estimated Costs and Benefits by Alternative (source: Midmarket Analysis)

Economic Appraisal Inputs	Alternative			
	1	2	5	7
Total Volume (MBF)	0	77,229.00	22,163.00	50,884.00
Roads, New and Repair (Miles)	0	98.00	34.10	66.30
Pond Log Value (\$/MBF) ¹	0	512.47	525.09	519.75
Stump to Truck Costs (\$/MBF) ²	0	156.19	149.90	149.63
Transportation Costs (\$/MBF) ²	0	32.42	32.43	31.25
Administration Costs (\$/MBF)	0	26.26	26.26	26.26
Temporary Development Costs (\$/MBF) ²	0	17.67	21.79	20.20
Road Development Costs (\$/MBF) ²	0	153.19	185.05	160.90
Total Harvest Costs (\$/MBF)	0	385.81	415.43	388.24
Conversion (\$/MBF) ³	0	126.66	109.66	131.51
Profit and Risk Margin (\$/MBF)	0	41.01	38.11	40.31
Net Stumpage Value (\$/MBF)	0	85.65	71.55	91.20

Source: Fletcher 1998.

1 Pond log values from Table Timber-12.

2 Costs from timber appraisal spreadsheet.

3 Conversion = pond log value - total harvest costs.

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Nontimber Harvest Values

Neither the PNV nor TSPIRS accounting conventions consider nonuse values. Land uses that result in decreased visitations or in a change from higher-valued to lower-valued visitor use will result in a net loss to society. Likewise, any activities which decrease society's willingness-to-pay for the area result in a loss.

It is not possible to quantitatively compare these priced and nonpriced values. The proposed action could result in a loss of nonuse values due to decreases in "nature" tourism and decreases in societal willingness-to-pay for post-logged landscapes. Due to the limited access of the Project Area, this loss is expected to be proportional to the amount of access gained by implementing an action alternative, and is expected to be minimal.

Of the action alternatives, Alternative 2 harvests the most seen acreage and may create the greatest visual impact to the nonconsumptive user. Alternative 5 harvests the least seen acreage and could have the least amount of visual impact, with the no action alternative preserving the highest level of nonuse values.

Cumulative Effects

The cumulative effects of each of the alternatives on the economic and social environment are difficult to estimate. There are a wide variety of factors affecting the employment, income, receipts, population, life-style, and community stability of Southeast Alaska. While it is not easy to project the incremental effects of the proposed actions on the Project Area, there are two facets of long-term timber harvest in the Project Area that can be addressed.

First, from the standpoint of employment, personal income, population, community services, and community stability, there is substantial benefit to maintaining long-term timber harvest levels. The receipts generated, including revenue to the U.S. Treasury, payments to the State of Alaska, taxes, and dollars brought into the community, all represent an economic benefit of continued timber harvest activity. The TLMP Final EIS (1997) schedules areas for long-term timber harvest activity. The Sea Level Project Area is one of the areas scheduled to meet these economic and social needs.

The second facet of a long-term timber harvest that can be addressed is the alteration of the natural environment that takes place when roads are constructed and timber is harvested. Some of the economic and social value of Southeast Alaska is dependent on its natural setting. The recreation and tourism industry is based primarily on the natural conditions and scenic quality. As more and more acres of National Forest System lands and other lands are converted from a natural condition to a managed forest, the activities dependent on and the values attributed to the natural state of the forested land will be affected.

The balance necessary to maintain a viable or even robust economic and social environment is set at a National Forest level, not at a project level. Based on regional standards and guidelines, the action alternatives have been constructed to minimize the negative cumulative effects on the economies and community values of the affected communities when considering the total resource. Cumulative effects on employment are best displayed in the TLMP Final EIS (1997). This analysis indicates that for the Ketchikan area as a whole, National Forest System-based timber employment and commercial fishing employment will remain fairly constant, while recreation and tourism employment will increase in the future. Harvesting in the Sea Level Project Area is included as part of the overall harvest level assumed as a basis for this projection.

One consequence of timber harvests at the level projected by the Forest Plan is the degree of continued stability of communities dependent on timber from the Project Area. The analysis conducted for this project suggests that the timber supply in the Project Area could be reduced following the next several entries (see the Silviculture and Timber and Cumulative Effects sections). To the extent that this is correct, timber-dependent communities would suffer losses which would vary by their degree of dependency on the timber industry. This would result in some community residents finding employment in other timber-producing geographic areas.

Community Stability

Timber harvest and wood processing is one of a variety of ways of maintaining community stability. Value-added opportunities, such as the further processing of wood products (the manufacture and export of plywood, medium density fiberboard, specialty cedar siding and roof shakes, etc.) is being either considered, planned or to a limited extent, implemented on a trial basis (for example, Lewis Reef Development) to supplement community employment in association with expanding existing natural resource-based industries such as tourism and sport fishing.

The analysis conducted for this project suggests that the timber supply in terms of old-growth timber in the Project Area could be reduced following the next several entries (see the Silviculture and Timber and Cumulative Effects sections). As the mature timber resource base is harvested, and yearly harvests decrease in volume, it is probable that fewer workers would be required for timber harvest and transport to the Sea Level area. This reduction in local work force could result in a decreased population within logging communities currently

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living in and adjacent to the primary zone of influence of Ketchikan. Alternately, more workers might increase their commuting distances or change employment patterns such as living part time at work camps. Decreasing timber volumes or the halting of harvests from the Project Area in certain years could also result in a reduced labor force at local and regional processing facilities and other support facilities, and could have ripple effects throughout the regional economy. For specific information concerning the communities surrounding the project area, refer to TLMP EIS, 1997.

Environmental Justice

The communities of Saxman and Metlakatla have significant Native populations and have been evaluated for disproportionate or adverse environmental effects of the proposed action. Community outreach in these Native communities in the form of subsistence hearings in Saxman (July 16, 1998) and Metlakatla (August 1, 1998) and a briefing of the Metlakatla City Council (June 23, 1998) were undertaken to identify specific issues concerning the Sea Level project. Neither subsistence hearing resulted in concerns regarding the Sea Level project. The briefing of the Metlakatla City Council indicated an interest in timber that may be available from the Sea Level project area for the Metlakatla Indian Community sawmill. At the time of the briefing, the City Council did not see an immediate need for additional timber, given the depressed timber market and the relatively high cost of production.

Comments on the TLMP Supplement Draft EIS (1990) from the Saxman community expressed concern about the effects of timber harvesting on subsistence salmon streams. They expressed opposition to clearcutting and prefer only limited road construction. People commenting on the Revised Supplement Draft EIS Preferred Alternative were concerned about their traditional lifestyle and what the consequences of the timber program would be to their quality of life if the mill was closed and harvest levels reduced. Even though they want protection of the subsistence resources they use, they are concerned about their families (TLMP Final EIS, page 3-640). The Socioeconomic Panel predicted that Saxman would benefit the most from implementing TLMP Alternatives 4 and 5, although with risks of decreased timber employment. Alternatives 3 and 6 received similar ratings, although with less certainty and greater potential for neutral rather than positive effects. Although not rated by the panel, the effects of Alternative 11 (the TLMP Selected Alternative) would be similar to those of Alternative 3 (TLMP Final EIS, page 3-642).

Comments on the TLMP Revised Supplement Draft EIS from the Metlakatla community expressed desires to protect subsistence, that both subsistence and timber harvesting are important, and concerns about small mills and employment (TLMP Final EIS, page 3-604). Implementation of TLMP Alternatives 2, 3, and 6 were predicted by the Socioeconomic Panel to most likely have the least effects either way on Metlakatla. Although not rated by the panel, the effects of TLMP selected Alternative 11, would be similar to Alternative 3 (TLMP Final EIS, page 3-606).

Mitigation

Mitigation measures could be undertaken to improve net national benefits from the Project Area. This Project addresses only timber investment opportunities. Alternatives 2, 3, 4, and 5 show a negative PNV based on the midmarket analysis, while Alternative 6 shows a positive PNV. Other natural resource investment opportunities may offer better investment choices, and at the same time, contribute to mitigating potential community stability goals.

Monitoring

A monitoring plan has been developed for the Tongass National Forest by the Forest Planning Team and is described in the Forest Plan (1997).

Project-specific monitoring that is unique to the Sea Level Project Area has been identified for several resources. Project-specific monitoring is not identified for socioeconomic resources in the Sea Level Project Area.

Subsistence

Key Terms

Alaska National Interest Lands Conservation Act (ANILCA)—requires evaluations of subsistence impacts before changing the use of certain Federal lands.

Nonrural—generally a community with more than 7,000 people; does not qualify for priority use of subsistence resources.

Rural—any area of Alaska determined by the Federal Subsistence Board to qualify as such; qualifies for priority use of subsistence resources.

Subsistence—customary and traditional uses by rural Alaskans of wild renewable resources.

Wildlife Analysis Area (WAA)—a division of land designated by Alaska Department of Fish and Game (ADF&G) and used by the USDA Forest Service for wildlife analysis.

Affected Environment

Many Southeast Alaskan communities use natural resources as a base or supplement to their livelihoods. Nearly a third of rural households in Southeast Alaska get at least half their meat and fish by hunting and fishing (Holleman and Kruse 1991). Fish and game are widely preferred sources of food among Southeast Alaskan households, regardless of their incomes. Examples of major subsistence resources include deer, salmon, halibut, trout, harbor seal, crab, clams, waterfowl, and berries. Findings from the Tongass Resource Use Cooperative Study (TRUCS) indicate that "members of the highest income group have the highest mean harvest and the lowest mean percent of meat derived from subsistence activities" (Kruse and Muth 1990).

Subsistence activities represent a major focus of life for rural residents. These resource or subsistence gathering activities include hunting for deer, bear, marine mammals, and birds; digging clams; catching fish and shellfish (crabs, shrimp); harvesting marine invertebrates; trapping furbearers; collecting firewood; collecting herring eggs; and collecting berries and edible plants and roots. Subsistence goods may be eaten, traded, given away, or made into an item of use or decoration. For example, the fur from the marten or sea otter may be used for regalia costumes which are used in ceremony and dance.

Even for households which can afford to purchase all their own food, the act of gathering subsistence resources is an important cultural aspect reflecting deeply held attitudes, values, and beliefs. Some traditional foods are not available through any other means than subsistence, and often, the occasions for gathering wild foods and edible plants are social events. Historical patterns of movement such as the annual cycle of dispersal into small family groups at summer fishing camps and then to larger gatherings at protected winter villages are also linked to the tradition of subsistence gathering.

Average per capita income may or may not indicate the importance of subsistence to a community. While individuals of low income may have a greater dependence on subsistence gathering, individuals with a higher income may simply be in a position to have a more comfortable life-style because they combine their subsistence activities with their ability to purchase goods. Higher income does not deter an individual from gathering resources and sharing those with friends and family (Kruse and Muth 1990).

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Sharing of subsistence resources is important not only between households within communities, but also with extended families and friends in other areas. This includes sharing with those households which are unable to participate in the harvest of resources. And, because some communities have access to resources not found in other communities, sharing of subsistence resources occurs between as well as within communities.

The importance of subsistence is recognized in both State and Federal laws. With the passage of the Alaska National Interest Lands Conservation Act (ANILCA), Congress recognized the importance of subsistence resource gathering to the rural communities of Alaska.

In 1988, a detailed subsistence resource and use inventory of the Tongass National Forest was started as part of the TLMP Revision process. The Tongass Resource Use Cooperative Study (TRUCS) of 1988, was conducted by the University of Alaska's Institute of Social and Economic Research in conjunction with the U.S. Forest Service and the Division of Subsistence of the Alaska Department of Fish and Game (ADF&G) (Kruse and Frazier 1988).

In the TRUCS, researchers went to over 30 communities in Southeast Alaska and conducted interviews with randomly selected households about their 1987 subsistence uses. As part of the interview, household residents were also asked to draw special maps of the areas used for hunting and fishing. As stated by Kruse and Frazier in the TRUCS (1988), it should be noted that all figures used in reporting subsistence are based on a sample of households. Therefore, it is entirely possible that actual amounts harvested were either higher or lower than reported by sample households. A detailed description of the survey is found in the Tongass Resource Use Cooperative Survey Technical Report Number One from the Institute of Social and Economic Research, University of Alaska.

Affected Areas

Based on identified use of the Project Area, the following communities were selected to be analyzed: Metlakatla, Meyers Chuck, Saxman, Wrangell, and Ketchikan. Of these communities, all are designated rural except Ketchikan.

Metlakatla

Metlakatla is 25 nautical miles south of the Sea Level Project Area and on the west side of Annette Island. The 1990 census reported there were 1,407 people living in the community, of which 1,175 or 84 percent were Native. This community was established in 1887 when a band of Tsimshian Natives migrated from northern British Columbia. In 1891, Congress designated Annette Island an Indian reservation, the first in Alaska. The community did not participate in the Alaska Native Claims Settlement Act of 1971 (ANCSA) and does not have a village corporation. Their economy is based on sawmill operations of the Annette Hemlock Mill operated by Ketchikan Pulp Company, Annette Island Packing Company (a community owned cannery), Tamgas Creek Hatchery, and Metlakatla Indian Community Services.

Metlakatla subsistence use is over 71 pounds of edible harvest consumed per person per year. This supplements their relatively low income and traditional cultural life-styles. In the Project Area, Metlakatlans fish for salmon and hunt for deer.

Meyers Chuck

Meyers Chuck is a small fishing village with a seasonal population of 30 to 40 people located about 35 miles from the Project Area along the Clarence Strait on the southwest tip of Cleveland Peninsula. A natural, well protected harbor, Meyers Chuck has been a shelter for passing fishing boats caught in the stormy waters of Clarence Strait. Beginning in the late 1800s, the community grew after a cannery was established in Union Bay in 1916. Fishing is still the basic source of income, although declining salmon populations have caused some residents to seek work in Ketchikan or on Prince of Wales Island. A community-sponsored fish hatchery was constructed in 1977, with the hope of improving local fish supplies.

Meyers Chuck residents depend on subsistence activities to supplement the relatively low cash economy. Fish, berries, deer, and other local protein sources are an important element of the local economy. Subsistence use of salmon and deer within the Project Area has been reported by residents of Meyers Chuck. Over 414 pounds of edible harvest are consumed per person per year.

Saxman

Saxman was settled in 1894 by Tlingit Natives from Cape Fox and Tongass Islands. The town was named after a Presbyterian teacher named Samuel Saxman, who along with a Native village elder, were lost at sea looking for a new school site. When established, a few Tlingits from the old village of Kahshakes joined the growing community. Under ANCSA, the Cape Fox Corporation was formed and is the economic base for Saxman. Cape Fox Corporation is counted among one of the major employers in the Ketchikan area, including the Westmark Cape Fox Lodge, Cape Fox Tours, and as owner of 23,000 acres of forested land.

Today, about 266 villagers consume an average of 89 pounds of food per capita per year from subsistence activities. In the Project Area, residents of Saxman travel 30 miles to fish for salmon, hunt for deer and bear, and trap for marten, crab, and shrimp.

Wrangell

Wrangell, located in the east-central portion of Southeast Alaska, is on the northern tip of Wrangell Island about 7 miles from the mouth of the Stikine River and approximately 50 air miles from the Project Area. The 1990 population is reported as 2,479. Wrangell began as an important Tlingit site primarily because of its proximity to the Stikine River. Starting in 1811, the flags of three nations—England, Russia, and the United States—have flown over this community, with Russian and English interests centered on fur trading. When the United States purchased Alaska in 1867, a military post was established. Prospecting for gold along the Stikine River and later in the Cassiar District of northern British Columbia dwindled by 1916, and the economy changed to fishing, crabbing, and shrimping. Today, fishing and fish processing dominate Wrangell's economy. More than 100 residents fish commercially. It is the major source of income for 50 percent of those residents. Tourism is a growing economic influence in the Wrangell area.

Wrangell subsistence use is approximately 164 pounds consumed per person per year. In the Project Area, their reported use is for deer, salmon, crab, shrimp, and halibut.

Ketchikan

Ketchikan is located in southern Southeast Alaska, on the southwest side of Revillagigedo (Revilla) Island on Tongass Narrows opposite Gravina Island. Ketchikan is approximately 30 air/water miles from the Project Area.

The Ketchikan area was a summer fishing camp for the Tlingit Indians. Development began with a saltery at the mouth of Ketchikan Creek. Ketchikan was a boom town in the late 1800s. Since the early 1900s, timber products have been an important economic factor in Ketchikan. Because of its location as a transportation center, fishing center, and focus for the region's timber industry, Ketchikan grew rapidly in the 1950s. In 1954, a world-scale pulp mill was built in Ward Cove, with a computer-aided, laser-scanning sawmill added to the site in 1989. Besides the pulp and saw mills, Ketchikan has over a dozen large and small fish processing establishments. While mining does occur within the area, it is not currently of any major economic significance.

Ketchikan's 1990 borough population was reported as 13,828. Ketchikan was not included in the TRUCS study, since it is defined as non-rural. Information for this community reflects ADF&G sport fish and game harvest information.

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Other Communities and Camps

In addition to communities already discussed, the Shoal Cove and Shelter Cove Camps also use the Project Area for subsistence gathering purposes. Subsistence use by these communities is expected to have minimal impact on the area.

Table Subsistence-1 presents information taken from the 1988 TRUCS report detailing the importance of subsistence use for individual communities using the Project Area. Total harvest figures include additional food items, plants, and berries.

Table Subsistence-1
Per Capita Subsistence Harvest for Rural Communities Which Use the Project Area for Subsistence Gathering Activities

Community	Total Harvest lbs.	Deer Harvest lbs.	Other Mammal lbs.	Salmon Harvest lbs.	Other Fish lbs.	Shellfish Harvest lbs.	Birds/ Eggs lbs.	Misc. Plants lbs.
Metlakatla	71	11	1	20	18	15	2	4
Meyers Chuck	414	22	37	105	176	52	14	8
Saxman	89	17	7	33	19	9	1	3
Wrangell	164	20	24	30	43	41	2	4

Source: TRUCS 1988.

Affected Resources

The Project Area supports a wide variety of resources that contribute to the maintenance of the subsistence life-style. Identified activities include harvest of fish, waterfowl, bear, deer, furbearers, clams, crab, and shrimp; and the gathering of berries and seaweed. In addition, many residents use trees for firewood and lumber, and spruce roots and cedar bark for cultural expression. Of these resources, fish, deer, black bear, furbearers, and waterfowl may be affected by the Sea Level Project and are analyzed in the following discussion.

Fish

Salmon and trout are the principal subsistence fish resources in the affected area. Pacific salmon are harvested in both fresh and saltwater in a variety of ways throughout the year in the Project Area. Pink and chum salmon are the most heavily used subsistence species because of their availability within the Project Area. Sockeye and chinook salmon are not as common in the Project Area. Traditional harvest sites for salmon within the Project Area include pink and chum salmon at Fish Creek. Some pink, sockeye, and chum salmon are harvested at the mouth of Carroll Creek.

Table Subsistence-2 lists the stream, number of subsistence permits issued, and the number of fish taken by species for subsistence purposes. Neets Bay and at the mouth of Carroll Creek are shown as the principal salmon subsistence use areas in the Project Area.

Table Subsistence-2
Salmon Personal Use Permits and Harvest near the Project Area, 1985-94

Location & Year	Permits Reported	Salmon Taken			
		Chinook	Sockeye	Pinks	Chums
Carroll Creek—1985	3	0	3	34	2
Carroll Creek—1986	1	0	10	0	0
Fish Creek—1986	1	0	0	50	20

Source: ADF&G commercial and subsistence harvest data

Wildlife

For record keeping purposes, the ADF&G has broken the Game Management Units (GMUs) into smaller areas called minor harvest areas. Minor harvest units are approximately comparable to Wildlife Analysis Areas (WAAs). WAAs and their corresponding Value Comparison Units (VCUs) within the Sea Level Project Area are found in Table Subsistence-3.

Table Subsistence-3
VCUs and WAAs Within the Sea Level Project Area

WAA	VCUs
405	7542, 7552, 756, 757, 759
406	746, 753

Source: Burns 1998.

Note: Only about 78 percent of WAA 405 and about 45 percent of WAA 406 are within the Sea Level Project Area.

Deer

Harvest of deer on the Project Area is from rural users and non-rural users. Communities whose residents have hunted deer in WAAs 405 and 406 since 1984 include Ketchikan and Juneau. Subsistence users came from: Metlakatla, Meyers Chuck, Saxman, Thorne Bay and Wrangell (ADF&G Harvest Data). Access is limited to boat or float plane.

Hunting effort in WAA 405 and 406 increased during certain years due to the resumption of logging operations in the area. Most of the additional harvest is by logging camp residents at Shoal Cove, Shelter Cove, and Elf Point. Harvest may increase as more logging, road building, and other developments occur in the Sea Level Project Area.

The general hunting season is August through late December. Harvest is concentrated during two time periods: the first few weeks of the season in August, and later in November when

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the rut occurs. Most of the deer harvest in the Project Area occurs on shorelines or timber harvest access roads. Communities that harvested deer within the Sea Level Project Area during the 1987 to 1996 period are shown below in Table Subsistence-4.

Table Subsistence-4

WAAs within the Project Area Where Subsistence Communities Harvested Deer During 1987-1996

WAA	Metlakatla	Meyers Chuck	Saxman	Wrangell	Swan Lake	Revilla/406	Shoal Cove
405						X	
406			X			X	X

Source: Burns 1998. ADF&G Deer Harvest Data Base.

The average number of deer harvested from 1987 through 1996, by each community for WAAs 405 and 406, is shown in Table Subsistence-5. Ketchikan was included to illustrate the relative impact this community has on the area. An average of one deer per year was taken by hunters from rural communities in WAA 405. An average of three deer per year were taken by hunters from rural communities in WAA 406.

Subsistence hearings held in Ketchikan and Saxman revealed that some Saxman residents do not report their deer harvest to ADF&G, which indicates that the ADF&G harvest data is under-reporting the importance of this area to residents of Saxman. Another problem with the ADF&G harvest data is that some Saxman residents have a Ketchikan mailing address, so some Saxman resident deer harvest is being reported as Ketchikan resident harvest.

Table Subsistence-5

Average Deer Harvest by Community and WAA for the Years 1987 to 96

Community	WAA 405	WAA 406
Ketchikan	20	89
Metlakatla	0	0
Saxman	0	1
Shoal Cove	0	2
Revilla/406	1	1
Wrangell	0	0
Swan Lake	0	0
Outside Alaska	0	1
Average Deer Harvest	21	94
Average Nonrural Harvest	20	91
Average Rural Harvest	1	3
Population Needed To Support Average Rural Harvest	10	30

Source: ADF&G Deer Harvest Data For Southeast Alaska 1987-96.

Table Subsistence 5 shows that very few deer are needed to meet the rural demand at this time. Even if the rural harvest were doubled (to account for Saxman being under reported) the population needed to support that harvest would be only 20 animals in WAA 405 and 60 animals in WAA 406.

The percentage of a community's deer harvest occurring within WAAs 405 and 406 is illustrated in Table Subsistence-6.

Table Subsistence-6
Average Deer Harvest by Community 1987-1996 and Percent of Total Harvest that Occurred Within WAAs 405 and 406

Community	Average Deer Harvest Within Project WAAs	Average Deer Harvest All Areas	Percent of Harvest Within Project WAAs
Ketchikan	110	1,628	6.7
Metlakatla	0	39	0.0
Saxman	1	5	25.5
Shoal Cove	2	2	62.5
Revilla/406	1	2	66.7
Wrangell	0	404	0.0
Swan Lake	0	0	0.0
Outside Alaska	1	66	2.0
Total Deer Harvest	115	2,146	5.4
Total Nonrural Harvest	111	1,695	6.6
Total Rural Harvest	4	452	0.9

Source: ADF&G Deer Harvest Data For Southeast Alaska 1987-96.

While Ketchikan accounted for the greatest number of deer harvested within the Project Area WAAs (110), it amounted to 0.1 percent of that community's total deer harvest (1,628). People living at the Shelter Cove and Shoal Cove Bay Logging Camp harvested all their deer from the Project Area WAAs. These logging camps are no longer in the Project Area; however, this level of harvest could be expected when another logging camp is moved in to harvest the proposed timber.

The TRUCS study (1988) produced a map that displayed areas used for subsistence deer hunting by Southeast Alaska subsistence households. This map shows that most of the Project Area has been used by one to five percent of subsistence households, with the exception of along the shoreline in Thorne Arm and Carroll Inlet.

Black Bear

Black bears occur throughout the Project Area and populations are currently stable. The TRUCS effort indicated that some black bear harvest was associated with subsistence use, but that community use varies widely. Bear tagging information from ADF&G indicates hunters were usually from the Ketchikan area; only five bear out of 139 were harvested by residents

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of rural communities. It is very possible that more bear were harvested by rural residents who had a Ketchikan or Ward Cove mailing address, but lived in Saxman.

Table Subsistence-7 displays the black bear subsistence (rural) harvest by WAA by year. Table Subsistence-8 displays the black bear harvest in WAAs 405 and 406 broken down by harvest of individuals from rural and non-rural communities.

Table Subsistence-7

Black Bear Subsistence (Rural) Harvest from 1986 to 1994 and Population Needed to Support Harvest Compared to Current Habitat Capability

WAA**	1986	1987	1988	1989	1990	1991	1992	1993	1994	Average Harvest Per Year	Population to Support Harvest*
405	0	0	0	0	0	0	0	0	0	0.0	0
406	0	0	0	0	3	0	0	0	2	0.6	6

Source: Burns 1998. Data derived from ADF&G harvest data.

* Population needed to support harvest assumes a 10 percent harvest of the population (pers. comm. D. Larsen, ADF&G Wildlife Biologist).

** Includes entire WAA, including portions outside the Project Area.

Table Subsistence-8

Black Bear Harvest by Rural and Non-rural Communities During 1986-1994

Year	WAA 405		WAA 406	
	Rural Harvest	Nonrural	Rural Harvest	Nonrural
1986	0	2	0	21
1987	0	1	0	17
1988	0	1	0	2
1989	0	2	0	19
1990	0	2	3	19
1991	0	1	0	11
1992	0	0	0	7
1993	0	2	0	17
1994	0	0	2	10
Total	0	11	5	123

Source: Burns 1998. ADF&G Black Bear Harvest Data Base.

Furbearers

Furbearer harvest supplements the seasonal income of many area residents. Different levels of trapping intensity exist, from the occasional trapper who targets primarily marten and otter close to shore, to those individuals pursuing all furbearers both near to and far from the road system. Harvest effort usually is concentrated along the saltwater/upland interface. Marten appear to be the most old-growth dependent of the furbearers and are trapped intensively from shore and along the road system. Tables Subsistence-9 and Subsistence-10 show furbearer subsistence (rural) harvest for 1988 to 1996 for WAA 405 and 406.

Table Subsistence-9
WAA 405 Furbearer Subsistence (Rural) Harvest from 1988 to 1996

Animal	1988	1989	1990	1991	1992	1993	1994	1995	1996	Total	Average Harvest Per Year	Population Needed to Support Harvest*
Beaver	0	0	0	0	0	0	0	0	0	0	0.0	N/A
Marten	0	0	0	0	0	0	0	0	0	0	0.0	0
Otter	0	0	0	0	0	0	0	0	0	0	0.0	0
Wolf	0	0	0	0	0	0	0	0	0	0	0.0	0

Source: ADF&G Data Base.

* Population needed to support harvest assumes a 40 percent harvest of the marten population and a 20 percent harvest of the otter and wolf populations.

Table Subsistence-10
WAA 406 Furbearer Subsistence (Rural) Harvest from 1988 to 1996

Animal	1988	1989	1990	1991	1992	1993	1994	1995	1996	Total	Average Harvest Per Year	Population Needed to Support Harvest *
Beaver	0	0	0	0	0	0	1	0	0	1	0.1	N/A
Marten	0	0	0	0	0	0	0	0	0	0	0	0
Otter	0	0	0	0	0	0	0	0	0	0	0	0
Wolf	0	0	0	0	0	0	0	0	0	0	0	0

Source: ADF&G Data Base.

* Population needed to support harvest assumes a 40 percent harvest of the marten population and a 20 percent harvest of the otter and wolf populations.

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All of the marten trapped in WAAs 405 and 406 were trapped by non-rural residents (Table Subsistence-11). Rural residents harvested none of the marten in WAAs 405 and 406 (ADF&G Marten Harvest Database). It should be noted that there are wide yearly variations in harvest levels.

Table Subsistence-11
Marten Harvest by Rural and Nonrural Communities During 1988 to 1996

Year	WAA 405		WAA 406	
	Rural Harvest	Nonrural	Rural Harvest	Nonrural
1996	0	11	0	22
1995	0	0	0	2
1994	0	17	0	4
1993	0	1	0	1
1992	0	0	0	6
1991	0	0	0	73
1990	0	6	0	20
1989	0	0	0	33
1988	0	3	0	68
Total	0	38	0	229

Source: Burns 1998. ADF&G Marten Harvest Data Base.

Waterfowl

A variety of species of ducks, along with Canada geese, occur in the Project Area, primarily along bays and estuaries. Identified sites with a history of waterfowl use that are within the Project Area include Gnat Cove Estuary and the head of Thorne Arm.

Marine Mammals

Seals are the main subsistence marine mammals in the Project Area. Seals are known to use the rocks in Carroll Inlet near Shoal Cove and the rocks near Snipe and Minx Islands in Thorne Arm. Wrangell and Saxman are known to harvest marine mammals in these areas (TRUCS 1988). For more information on subsistence marine mammals, see Appendix B.

810 Evaluation-Effects of the Alternatives

Introduction

Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA) requires a Federal agency having jurisdiction over lands in Alaska to evaluate the potential effects of proposed land-use activities on subsistence uses and needs.

This section evaluates how the proposed action alternatives could affect subsistence resources used by the rural communities found to use the Project Area, including: Metlakatla, Saxman, Meyers Chuck, Wrangell, and the non-rural community of Ketchikan. The subsistence

resource categories evaluated are deer, furbearers, waterfowl, black bear, salmon, other finfish, shellfish, other food and cultural resources, and firewood.

Criteria used to evaluate the effects of the proposed alternatives are: (1) changes in abundance or distribution of subsistence resources; (2) changes in access to subsistence resources; and (3) changes in competition from non-rural users for those resources. The evaluation determines whether subsistence uses in the Project Area or portions of the Project Area may be significantly restricted by any of the proposed action alternatives. The evaluation relies heavily upon the use of wildlife habitat capability models as well as upon ADF&G hunter survey data.

A decrease in deer habitat capability of less than 6 percent in the Project Area for all alternatives is illustrated in Table Subsistence-12.

Direct, Indirect, and Cumulative Effects on Subsistence Use of Deer

Table Subsistence-12
Percent Decrease from Current (1999) Deer Habitat Capability by Alternative,
Following Harvest of All Units.

	Alternative			
	1	2	5	7
Sea Level Project Area	0.0	-5.4	-2.8	-4.0

Source: Burns 1999.

Based on the outputs of the habitat capability models for deer, only minor changes in current habitat levels would occur in the Project Area. Current demand is assumed to be the average deer harvest from 1987-96, for each of the Project Area WAAs. There is not likely to be a significant restriction on subsistence use of deer due to the relatively low number of deer reported harvested by rural residents (Table Subsistence-5).

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Deer: Reasonably Foreseeable Future Actions

Table Subsistence-13 displays the effects on deer habitat capability of harvesting Sea Level and other planned harvest activities taking place on Revilla Island between now and the year 2007. Table Subsistence-13 also shows the deer habitat capability in 2007 as a percentage of the current habitat capability for all the WAAs on Revilla Island.

Table Subsistence-13

Deer Habitat Capability Reductions on National Forest System Lands, by Reasonably Foreseeable Project and WAA for Revillagigedo Island by 2007

WAA	Percent Habitat Capability Reduction for Deer on National Forest System Lands			Percent Present at year 2007*
	Upper Carroll ROD	Sea Level Alternative 2	Total Reductions	
404			0	100
405		3	3	97
406	1.0	2	3	97
407			0	100
408			0	100
509			0	100
510			0	100
511			0	100
Total	0.1	1	1	99

Source: Burns 1997.

* Percent of 1997 habitat capability present at year 2007 (TLMP 1997).

Note: Habitat capability assumes the harvested units are in the clearcut stage (0-25 years).

Table Subsistence-14 shows the percent decrease in deer habitat capability from 1954 to 2045. In 2045, all past harvest and proposed harvest is expected to be in the canopy closure stage. The canopy closure stage provides little in the way of food for deer since most understory vegetation is shaded out.

Table Subsistence-14

Percent Decrease from 1954 Habitat Capability for Deer When Harvested Units Reach the Canopy Closure Stage (2045).

	Alternative			
	1 (1999)	2 (2045)	5 (2045)	7 (2045)
Sea Level Project Area	-33.2	-41.6	-39.0	-40.3

Source: Burns 1999, from Habitat Capability Models and GIS.

To determine future demand for deer, the current demand was increased by 1.8 percent per year through the year 2010, and 1.5 percent per year from 2010 to the year 2040. Using the assumption that there will be a constant increase in demand for deer, and that deer habitat will be reduced as shown in Table Subsistence-14, at some time in the future subsistence demand may exceed the deer habitat capability; however, that exact time is difficult to predict given the many variables such as weather, human population increases, road access, and the desire to hunt certain areas. For an analysis of deer habitat capability through the year 2095, see the TLMP(1997) habitat capability analysis.

Effects resulting from changes in access may be the most significant potential effects of the project. If a road network connecting the Project Area to Ketchikan were to develop, the effects on subsistence users may be significant. Ketchikan hunters dominate the harvest within their land use area. At present, Ketchikan's use of the Project Area is limited by the lack of road access. Road access would make it easier for the much larger pool of Ketchikan hunters to use the Project Area.

A road connection is being considered between Ketchikan and Shelter Cove. If this connection is constructed, the additional access for Ketchikan hunters may cause additional impacts to subsistence users. All of the roads constructed in the Shelter Cove area for the Sea Level Project would be closed following project completion to mitigate some of the potential impacts of competition. Some existing roads would be closed as well. Still, the mainline roads would provide the opportunity for increased competition from non-rural hunters

Black Bear

Bear harvest records show only 6 bears are needed in the Project Area to meet current subsistence demand. Assuming that all suitable timber is harvested by the year 2095, there would be a 30.2 percent reduction in habitat capability in WAA 405 and a 26.4 percent reduction in WAA 406 (TLMP 1997). This is adequate to meet current and projected future demand. Therefore, there will not be a significant possibility of a significant restriction of subsistence use of black bear due to this project.

A road connection is being considered between Ketchikan and Shelter Cove. If this connection is constructed, the additional access for Ketchikan hunters may cause additional impacts to subsistence users. Also, habitat capability in the Shelter Cove area could be reduced as much as 20 percent due to road effects. All of the roads constructed in the Shelter Cove area for the Sea Level Project would be closed following project completion to mitigate some of the potential impacts of competition. Some existing roads would be closed as well. Still, the mainline roads would provide the opportunity for increased competition from non-rural hunters.

Based on the possible road connection and future possible timber harvest, cumulative effects will not cause a significant possibility of a significant restriction for black bear.

Fish

Salmon are a major subsistence food harvested in Southeast Alaska. The Water Resources, Fisheries, and Riparian sections of this chapter conclude that potential effects of the proposed timber harvest and road construction activities on salmon spawning and rearing habitat would be minimal or eliminated by applying the Forest Service Standards and Guidelines from the TLMP Final EIS (1997), and prescriptions described in detail in the Aquatic Habitat Management Handbook, Tongass Timber Reform Act, and Soil and Water Conservation Handbook. The application of these standards, guidelines, and prescriptions also minimize immediate and foreseeable impacts to other finfish.

Direct, Indirect, and Cumulative Effects on Subsistence Use of Other Resources

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Furbearers

The direct effects of the Project on furbearers are shown in Table Subsistence-15. Habitat capability estimates were derived from computerized models of management indicator species (MIS) for marten and wolf.

Table Subsistence-15
Percent Change from 1999 Furbearer Habitat Capability by Alternative

	Alternative			
	1	2	5	7
Marten	0.0	5.3	2.0	3.5
Wolf	0.0	5.3	2.8	4.0

Source: Burns 1999.

Marten will decrease less than 6 percent in the Project Area for all alternatives. Subsistence (rural) marten harvest is very low (Table Subsistence-11) and there is not a significant possibility of a significant restriction to subsistence use of marten due to direct effects.

Wolf habitat capability is currently well above the population needed to support current subsistence harvest levels (Tables Subsistence-9 and Subsistence-10). Therefore, is not a significant possibility of a significant restriction for wolves due to direct effects.

The TLMP (1997) shows a summary of the cumulative effects on marten and wolves. The TLMP (1997) indicates that if all suitable timber is harvested, by the year 2095, there could be a 20 to 40 percent reduction in habitat capability, from 1954, for marten and wolf. Increased demand for marten and wolves is expected through the year 2095. At some point, demand could exceed supply for all alternatives, including the No Action Alternative.

A road connection is being considered between Ketchikan and Shelter Cove. If this connection is constructed, the additional access for Ketchikan hunters may cause additional impacts to subsistence users. Also, habitat capability in the Shelter Cove area could be reduced as much as 20 percent due to road effects. All of the roads constructed in the Shelter Cove area for the Sea Level Project would be closed following project completion to mitigate some of the potential impacts of competition. Some existing roads would be closed as well. Still, the mainline roads would provide the opportunity for increased competition from non-rural hunters.

Based on the possible road connection, projected increase in demand and future possible timber harvest, cumulative effects will not cause a significant possibility of a significant restriction for marten and wolves.

Otter

Forest-wide standards and guidelines in the TLMP (1997) protect most important otter habitats. The Sea Level Project incorporates these standards and guidelines into all alternatives. No harvest is proposed within stream buffers or within 1000 feet of beach and estuary buffers. Effects on otter habitat are expected to be minimal due to the implementation of these standards and guidelines.

Waterfowl

Effects of the proposed action on waterfowl are expected to be minimal because no timber harvest will be permitted within 1,000 feet of estuaries or shorelines. Timber harvest unit

locations generally avoid important waterfowl areas, including: estuary grass flats, beach fringe, and borders of inland lakes and streams.

Marine Mammals

Forest-wide Standards and Guidelines in the TLMP (1997) will protect marine mammals in the Project Area. No harvest or road building is proposed near seal haulouts. Logging camps will be located appropriately to avoid conflicts with seal haulouts.

Firewood and Lumber

Current use of both live and dead timber for subsistence is very low throughout the Project Area. No need for wood in the Sea Level Project Area has been expressed. In terms of effects, there may be an immediate, localized, temporary use by logging camps, but indirect and cumulative demand is expected to return to current low use rates.

Other Resources

Other subsistence uses of the natural resources occur. Some examples are cedar bark gathering, berry picking, mushroom gathering, use of native plants for arts and crafts, use of bays and estuaries for shrimp and crab, and collection of other edible plants and animals.

Most of these activities are associated with a particular traditional site. These sites vary in locations and are not accurately mapped. The Sea Level Project could impact these sites if they fall inside proposed units.

ANILCA 810 Findings for Subsistence Use of the Project Area

Abundance and Distribution of Subsistence Resources

The harvest of old-growth habitat may reduce the abundance of deer, black bear, marten, and wolf based on the habitat capability models for these species. Timber harvest proposed by the action alternatives will reduce the deer habitat capability by less than six percent (Table Subsistence-12). Marten habitat capability in the project Area will be reduced by less than six percent (Table Subsistence-15).

The Sea Level Project is not expected to affect distribution of subsistence resources, but abundance may be reduced by the amounts shown earlier in this section. Direct effects of the project are not likely to cause a significant possibility of a significant restriction for subsistence use of deer, bear, marten, wolves, and other resources based on abundance.

As human populations increase, subsistence demand is expected to increase as well. There is not likely to be a significant possibility of a significant restriction to these subsistence resource for all alternatives from to the potential increase in demand for subsistence resources.

Access

Access to traditional subsistence-use areas will not be restricted by the proposed project. Traditional subsistence access is by boat to the beaches of the Project Area. The effect on access would probably be minor under all alternatives because no beach fringe will be harvested in the Project Area and less than one percent of the marine and estuarine habitat will be affected by logging activities.

New and rebuilt roads will provide access to areas that were not previously used for subsistence harvesting resources. Miles of road proposed for construction can be found in the Roads and Facilities section. In most of the Project Area, mechanized use of the road system will be limited because access to the roads will be by boat or plane.

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Road management prescriptions developed for Project Area roads take subsistence users' needs into consideration. All new roads except 6 miles (Alternatives 2 and 7) at Elf Point will be blocked to cars and trucks following project completion. Some existing roads will be blocked as well for maintenance cost reasons. Existing roads are currently not connected to the Ketchikan road system. Most road use is by off-road vehicles. Off road vehicles would still be able to use many of the blocked roads. Therefore, there would not be significant restriction to subsistence users due to restricted access.

A possible road connection between Ketchikan and Shelter Cove has been proposed. Access would be improved under this project for Ketchikan and Saxman residents. The road connection would not restrict subsistence user access.

Competition

Competition for subsistence resources in the Project Area is a scoping issue. Subsistence users are concerned with competition from residents of Ketchikan. Since Ketchikan residents are considered non-rural, this competition can be regulated if it starts to restrict non-rural residents' ability to obtain subsistence resources. In the Wildlife section, the cumulative analysis discussed a potential road connection between the Shelter Cove area and the Ketchikan road system. If such a connection is made, it would significantly increase the amount of rural and non-rural use of the area and could increase the amount of competition to the point that there could be a significant restriction in subsistence use of deer, bear, wolves and marten in the Project Area.

The Federal Subsistence Board may use its authority to regulate non-rural harvest of deer and has authority to prioritize the harvest of deer among rural residents when necessary to protect the resource. The current deer population level does not require restrictions on non-rural users.

There is no evidence to indicate that availability of salmon, finfish, shellfish, or other food resources to subsistence users would be affected by sport or non-rural harvest. Any increase in competition from non-rural Alaskan residents and nonresidents would not be substantial because of the availability of resources in the immediate vicinity and in the surrounding areas.

Summary

The above analysis indicates that the direct and cumulative effects of all alternatives will not represent a significant possibility of restrictions on subsistence use of deer, black bear, marten, wolves or otter in the Project Area. This is based on a comparison between harvest levels and habitat capability in the Project Area.

EIS Determinations

Section 810 (a)(3) of ANILCA requires that when a significant restriction may occur, determinations must be made with regard to whether:

- such a significant restriction of subsistence uses is necessary and consistent with sound management principles for the utilization of public lands;
- the proposed activity will involve the minimum amount of public lands necessary to accomplish the purposes of such use and occupancy, or other disposition; and
- the steps to be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions.

Necessary, Consistent with Sound Management of Public Land

Alternative 7 has been examined to determine whether the associated potential restriction to subsistence use is necessary, consistent with the sound management of public lands. Standards used for the review included: (1) the Multiple Use Sustained Yield Act of 1960; (2) the National Forest Management Act (NFMA) of 1976 and its implementing regulations; (3) the Alaska National Interest Lands Conservation Act (ANILCA) of 1980; (4) the Alaska Regional Guide (1983); (5) the Tongass Land and Resource Management Plan; (6) the Tongass Timber Reform Act (TTRA) of 1990; (7) the Alaska State Forest Practices Act; (8)

the Alaska Coastal Zone Management Program; (9) Subsistence Management and Use Handbook (1985); and (10) Subsistence Evaluation and Finding (FSH 2609.25).

ANILCA placed an emphasis on the maintenance of subsistence resources and life-styles. However, the Act also provided for adequate opportunity for satisfaction of the economic and social needs of the State of Alaska and its people, and recognized public lands necessary and appropriate for more intensive uses. The Act also required the Forest Service to make available for harvest 4.5 billion board feet of timber per decade from the Tongass National Forest. The TTRA removed the 4.5 billion board foot requirement from ANILCA, but directed the Forest Service to seek to meet market demand for timber to the extent consistent with providing for the multiple use and sustained yield of all renewable forest resources, and subject to applicable law.

The Sea Level Project is necessary as a component of the timber management program designed to implement the Forest Plan, and meet TTRA direction. There is currently a limited timber supply from other sources, and an under-utilized mill capacity in the region. The Selected Alternative provides the most volume to contribute to the Forest Service's actions to seek to meet market demand while providing for other resources and uses. Current timber market analysis indicates that the timber demand exceeds the timber supply. The timber volume provided by each alternative will help to bridge that gap. This volume serves as a component of the 10-year timber sale schedule which attempts to provide timber to industry in an even timber flow over the planning cycle. The timber volume is also a substantial component of the timber sale program to be offered in the next 5 years on the Ketchikan Area to seek to meet annual market demand. Timber volume from other areas of the Tongass National Forest is not likely to be available to replace this volume in a reasonable time frame.

The action alternatives present three ways to meet the objectives of the Forest Plan and TTRA for timber harvests while also providing protection measures for forest resources, especially for subsistence. They are consistent with the Forest Plan, laws, regulations, policies, public needs, and the capabilities of the land.

Based on a review of the subsistence hearing testimony and the analysis conducted in the FEIS, it is apparent that all of the action alternatives involve some potential impact to subsistence deer, wolf and marten use in the future. There is no alternative that would meet TLMP and TTRA objectives and yet avoid all impacts to subsistence species somewhere in the Tongass National Forest. Therefore, based on the analysis of the information, it is determined that the Sea Level Project is necessary, consistent with sound management of public lands and strikes a balance between meeting the needs of the public and protecting forest resources.

Amount of Land Necessary to Accomplish the Purpose of the Proposed Action

The amount of public land involved to implement the each alternative is (considering sound multiple-use management of public lands) the minimum necessary. The Sea Level Project Area was selected to become part of the timber sale schedule because it is designated as a multiple use area that permits timber harvest in the Forest Plan. The Forest Plan assigned land use designations of timber production, Modified Landscape and Scenic Viewshed LUDs to approximately 60 percent of the Project Area. This designation provides for resource use and development for commodity resources such as timber. The Forest Plan allocated the remaining 40 percent of the Project Area to LUDs which do not allow programmed timber harvest, including the existing old growth related habitats.

In all alternatives, protection from development of the Carroll Point Peninsula was accomplished with the Semi-Remote Recreation and Old Growth Habitat LUDs in the Forest Plan. The small Old Growth Habitat Reserves in each VCU further strengthen this protection and provide for subsistence uses in the Fish Creek and Gokachin Creek shore and the Painted

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Creek area. Additionally, moving the Small Old Growth Habitat Reserve in VCU 7560 from Minx Islands to near Gnat Cove in Alternative 7 strengthens the old growth reserve strategy in the future. Beach and estuary fringe, riparian buffers, and connecting corridors implemented as part of the Forest Plan also strengthens the old growth strategy and protect important subsistence resources. Deer, marten and black bear will all benefit from these deferrals and is responsive to minimizing the amount of land while meeting overall project objectives.

Each alternative also provides a sound location and design for all harvest units and roads. The minimum amount of land and roading was used to resolve resource concerns while meeting the purpose and need for the project in a practical and efficient manner. All alternatives harvest less than 20 percent of the available commercial forest land in the project area. Resources were protected to the maximum extent practicable.

Choosing any of the alternatives in the Sea Level Project (including the No-action Alternative) or locating the harvest in another location on the Ketchikan Area would not avoid or substantially lessen the risk to subsistence use in the future.

Most of the Tongass National Forest is used by one or more rural communities for subsistence purposes for deer hunting (TLMP 1997-Community Deer Harvest Map). The areas of most subsistence use are the areas adjacent to existing road systems, beaches, and the areas in close proximity to the communities. Much effort was taken to protect the highest value subsistence areas. Examples described previously regarding Fish Creek, Gokachin Creek, Gnat Cove, Painted Creek, and other areas are examples.

It is not possible to reduce harvest in one area and concentrate it in another without impacting one or more rural communities' important subsistence use areas. In addition, harvestable populations of game species may not be maintained in a natural distribution across the Forest if harvest was concentrated in specific areas. A well-distributed population of species is also required by the Forest Service regulations implementing the NFMA.

Therefore; it is my determination that the Sea Level Project involves the minimum amount of public land necessary and strikes a balance between meeting the needs of the public and protecting the forest resources.

Reasonable Steps to Minimize Adverse Impacts Upon Subsistence Uses and Resources

Considerable steps were taken to minimize the impacts to subsistence use and resources. Each alternative reflects special efforts by the Forest Service to minimize the effects on resources used for subsistence by those rural communities that would be most likely to receive the highest priority in the event of an ANILCA section 804 "Tier II" restriction. Most areas of high value are historic beach fringe and stream buffers which are the areas of traditional use. In the Sea Level Project Area, the Gnat Cove and Minx Flats areas represent the highest current and historic subsistence use area. The Forest Plan LUDs and moving the Small Old Growth Reserve in VCU 7560 in Alternative 7 will minimize adverse impacts on subsistence uses. Alternative 5 defers harvest in these areas to protect subsistence resources. Alternative 2 follows the Forest Plan LUD strategy and standards and guidelines. The overall Forest Plan LUD strategy, alternatives to clearcutting, and the road access management strategy, represent reasonable steps to minimize adverse impacts to subsistence resources.

Each alternative reflects a reasonable balance between projected need for Tongass timber from the Project Area to help meet TLMP, ANILCA, and TTRA timber related employment objectives, and continued protection of subsistence uses and resources. Impacts on subsistence have been minimized through the development of the individual harvest units and road corridors, and through the formulation of the alternatives.

The Final EIS describes the mitigation measures that will be implemented as a part of each alternative. Most of the mitigation measures are designed to maintain fish and wildlife habitat productivity at the highest level possible, while still producing a supply of timber.

It is determined that reasonable measures to minimize impacts on subsistence have been adopted to the maximum extent practicable while still meeting the purpose and need for this project.

Final EIS Conclusions

The Record of Decision (ROD) for the Final EIS for the Sea Level Project includes a final finding about the significant restriction on subsistence uses that may result from implementation of the Selected Alternative. Below is a summary of the Final EIS evaluation and findings.

1. The direct effects from the action alternatives in the Sea Level Project do not present a significant possibility of a significant restriction of subsistence uses of deer, black bear, marten, wolf, otter, marine mammals, waterfowl, salmon, other finfish, shellfish, and other foods.
2. The potential foreseeable and cumulative effects from implementing the Forest Plan (1997) through the entire rotation period, including the no-action and action alternatives in the Project Area, do not present a significant possibility of a significant restriction of subsistence uses of deer, bear, marten, wolf and other resources.



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Table Subsistence-16 displays the summary comparison for subsistence use within the Project Area.

Table Subsistence-16
Summary Comparison of Alternatives

Activity/Resource	Units	Alternatives			
		1	2	5	7
Subsistence - Project Area					
High & Moderate Use Subsistence (TRUCS)	Acres harvested	0.0	0.0	0.0	0.0
Deer Habitat Capability	Percent of 1954 Habitat Capability	67%	58%	61%	60%
Deer Population Needed to Support Current Subsistence Harvest	Percent of 1954 Habitat Capability	0.7%	0.7%	0.7%	0.7%
Significant Possibility of a Significant Restriction					
Direct Effects:					
Deer	Response	No	No	No	No
Bear	Response	No	No	No	No
Furbearers	Response	No	No	No	No
Salmon	Response	No	No	No	No
Other Finfish	Response	No	No	No	No
Waterfowl	Response	No	No	No	No
Marine Mammals	Response	No	No	No	No
Indirect & Cumulative Effects of Implementing the Forest Plan Over the Entire Rotation:					
Deer	Response	No	No	No	No
Bear	Response	No	No	No	No
Furbearers	Response	No	No	No	No
Salmon	Response	No	No	No	No
Other Finfish	Response	No	No	No	No
Waterfowl	Response	No	No	No	No
Marine Mammals	Response	No	No	No	No

Source: Burns 1999.

Threatened and Endangered Species

Key Terms

Endangered—a species in danger of extinction throughout all or a significant portion of its range.

Threatened—a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Species of Concern—a species or group of species being considered by the U.S. Fish and Wildlife Service for listing as endangered or threatened, but for which conclusive data is lacking on its biological vulnerability and degree of threat. Formally known as a Category 2 Candidate Species.

Sensitive—a species (identified by the Regional Forester) whose population viability is of concern on National Forests within the region, and which may need special management to prevent their being placed on State or Federal threatened and endangered species lists.

Affected Environment

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS), under the authority of the Endangered Species Act (ESA) of 1973, as amended. Candidate species are those being considered for listing as threatened or endangered by the USFWS and NMFS. Species of concern are those species (formally known as "Category 2 Candidate species") for which there is information indicating the species might qualify for endangered or threatened status, but for which further evaluation is needed. The State of Alaska has an Endangered Species Law which authorizes the commissioner of the Alaska Department of Fish and Game (ADF&G) to list Alaska endangered species. The U.S. Forest Service Regional Forester can also designate species as "Sensitive" (see Key Terms above).

For the complete analysis on threatened, endangered, or sensitive species, please refer to the Biological Assessment and Biological Evaluation (BA/BE) which has been prepared for the Sea Level Project and is located in Appendix C of this EIS.



Goshawk

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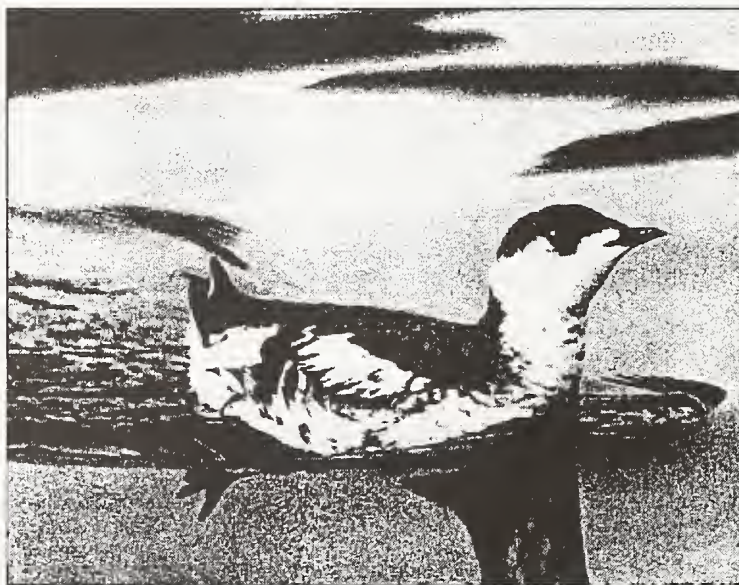
Federal Threatened and Endangered Species

Threatened and endangered species potentially occurring in the Project Area were identified through consultation with the USFWS and the NMFS. Consultation correspondences are located in the Sea Level Project Planning Record. Table Threatened and Endangered-1 lists the threatened and endangered species that may occur in or near the Project Area.

Table Threatened and Endangered-1
Threatened and Endangered Species that May Occur in or Near the Sea Level Project Area

Common Name	Scientific Name	ESA Status	Summary of BA/BE Finding
Humpback whale	<i>Megaptera novaeangliae</i>	Endangered	No effect
Steller sea lion	<i>Eumetopias jubatus</i>	Threatened	No effect
Snake River sockeye salmon	<i>Onchorhynchus nerka</i>	Endangered	No effect
Snake River spring/summer Chinook salmon	<i>Onchorhynchus tshawytscha</i>	Threatened	No effect
Snake River fall Chinook salmon	<i>Onchorhynchus tshawytscha</i>	Threatened	No effect
American peregrine falcon	<i>Falco peregrinus anatum</i>	Endangered	No effect

Source: Burns 1998.



Marbled Murrelet

Other Species

Other species may also be of concern under National Forest Management Act regulations, which require that viable populations be maintained in a well distributed manner. Although a primary purpose of the U.S. Forest Service Sensitive Species list is to ensure viability in a well-distributed manner for all species, other species with a viability concern in the Area need to be addressed. Other species are listed in Table Threatened and Endangered-2, which summarizes the findings of the BA/BE.

Table Threatened and Endangered-2
Alaska Region Species that May Occur in the Sea Level Project Area

Common Name	Scientific Name	Summary of BA/BE Finding
Alexander Archipelago wolf	<i>Canis lupus ligoni</i>	May affect individuals, not likely to adversely affect population viability
Keen's myotis (Keen's long-eared bat)	<i>Myotis keenii</i>	May affect
Marbled murrelet	<i>Brachyramphus marmoratus</i>	May affect individuals, no effect on population viability.
Harlequin duck	<i>Histrionicus histrionicus</i>	May affect individuals, not likely to adversely affect population viability
Olive-sided flycatcher	<i>Cantopus borealis</i>	No effect
Band-tailed Pigeon	<i>Columba fasciata</i>	May Effect
Columbia Spotted frog	<i>Rana luteiventris</i>	No effect
Ascending moonwort fern	<i>Botrychium ascendens</i>	Not likely to adversely affect
Super round-wedge moonwort fern	<i>Botrychium, unnamed</i>	Unknown
Willow, no common name	<i>Salix reticulata ssp. glabelllicarpa</i>	No effect
Broad-leaf twayblade	<i>Listera convallarioides</i>	May affect
Round-leaf bog orchid	<i>Platanthera orbiculata</i>	May affect individuals, not likely to adversely affect population viability
Pacific silver fir	<i>Abies amabilis</i>	May affect individuals, not likely to adversely affect population viability

Source: Burns 1998.

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Forest Service Sensitive Species

The Forest Service has identified Sensitive plant and animal species that could potentially occur in or near the Project Area. Table Threatened and Endangered-3 lists Sensitive species which may occur in the Area.

Table Threatened and Endangered-3
Alaska Region Sensitive Species that May Occur in the Sea Level Project Area

Common Name	Scientific Name	Summary of BA/BE Finding
Trumpeter swan	<i>Cygnus buccinator</i>	Not likely to adversely affect
Queen Charlotte goshawk	<i>Accipiter gentilis laingi</i>	May affect individuals, not likely to adversely affect population viability
Osprey	<i>Pandion haliaetus</i>	No effect
Peale's peregrine falcon	<i>Falco peregrinus pealei</i>	No effect
Goose-grass sedge	<i>Carex lenticularis</i> var. <i>dolia</i>	No effect
Edible thistle	<i>Cirsium edule</i>	No effect
Davy mannagrass	<i>Glyceria leptoctachya</i>	May affect individuals, not likely to adversely affect population viability
Wright filmy fern	<i>Hymenophyllum wrightii</i>	May affect
Truncate quillwort	<i>Isoetes truncata</i>	No effect
Calder lovage	<i>Ligusticum calderi</i>	Not likely to adversely affect
Choris bog orchid	<i>Platanthera chorisiana</i>	May affect individuals, not likely to adversely affect population viability
Bog orchid	<i>Platanthera gracilis</i>	Not likely to adversely affect
Loose-flowered bluegrass	<i>Poa laxiflora</i>	May affect individuals, not likely to adversely affect population viability
Straight-beak buttercup	<i>Ranunculus orthorhynchus</i> var. <i>alaschensis</i>	Not likely to adversely affect
Queen Charlotte butterweed	<i>Senecio moresbiensis</i>	Not likely to adversely affect

Source: Burns 1998.

Wildlife

Key Terms

Carrying capacity—the maximum number of a wildlife species that a certain area will support through the most critical period of the year.

Habitat—the sum total of environmental conditions of a specific place that is occupied by an organism, population, or community of plants or animals.

Habitat capability—an estimated number of animals that a habitat can sustain.

Large Woody Debris (LWD)—any large piece of relatively stable woody material having a diameter of at least four inches and a length greater than three feet that intrudes into the stream channel.

Management Indicator Species (MIS)—species of vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities.

Viable population—a population with the estimated numbers and distribution of reproductive individuals to maintain the population over time.

Wildlife Analysis Area (WAA)—divisions of land used by the Forest Service that correspond to Minor Harvest Areas used by the Alaska Department of Fish and Game (ADF&G).

Affected Environment

Alaska's wildlife are valuable for aesthetic, economic, recreational, ecological, and subsistence reasons. Over 350 species of mammals, birds, amphibians, and reptiles occur on the Tongass National Forest, and most of these, except brown bear, can be found in the Sea Level Project Area. They occupy a diverse range of land types and plant communities, and are variably adapted to climatic extremes, change in habitat, predation, and hunting pressure.

Wildlife Analysis Areas (WAAs) represent divisions of land that the Alaska Department of Fish and Game (ADF&G) uses for data collection purposes, and the Forest Service uses for wildlife analysis purposes. WAAs included in the Sea Level Project Area are 405 and 406 (Figure Wildlife-1). Specific VCUs that are included within Project Area WAAs are listed in Table Wildlife-1. See the Subsistence section of this chapter for a further analysis of wildlife species by WAA.

Wildlife Analysis Areas (WAAs)

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Figure Wildlife-1
Wildlife Analysis Areas

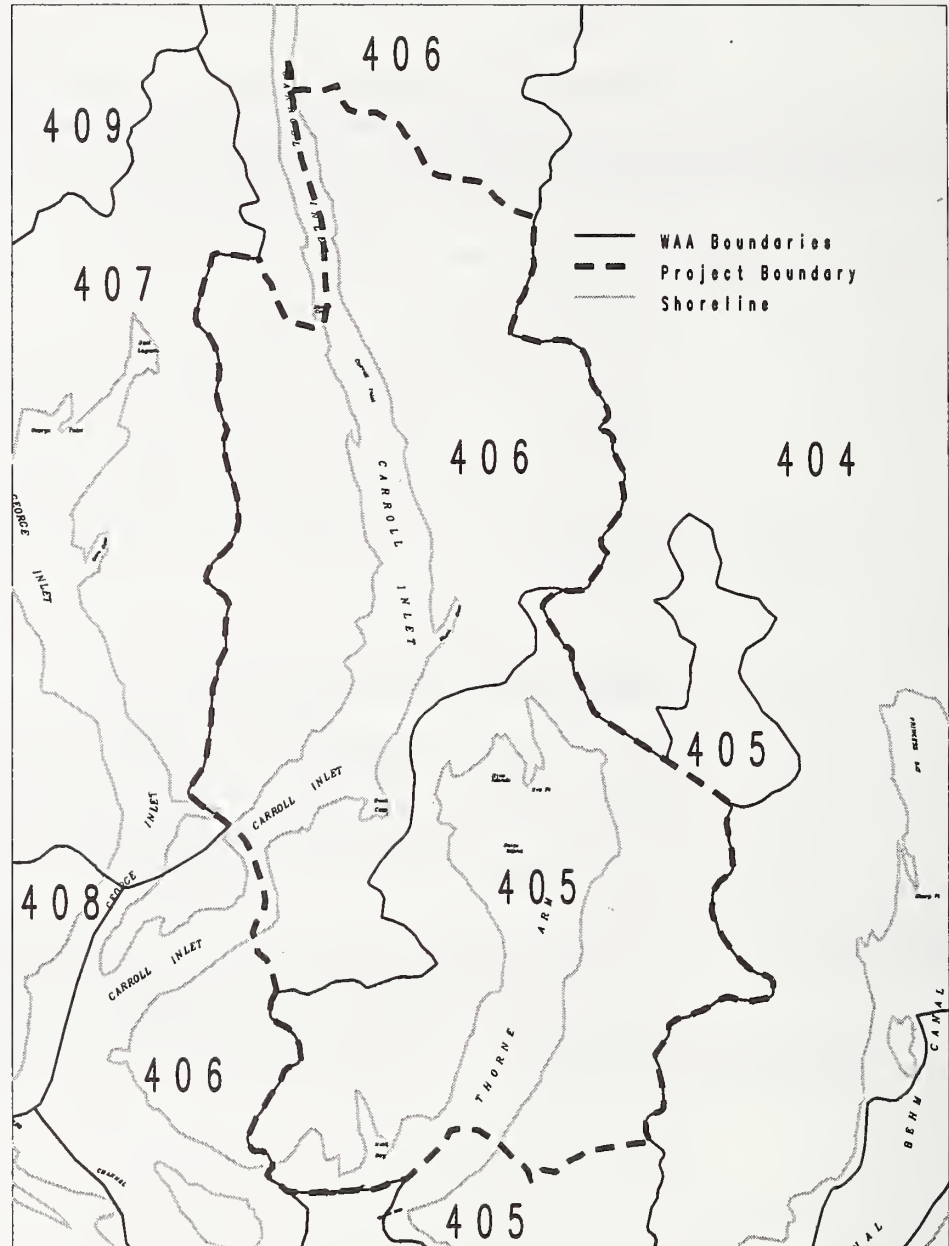


Table Wildlife-1
VCUs Within Wildlife Analysis Areas (WAAs) and Percent of the WAA that Includes the Project Area

WAA	Percent in Project Area	VCUs
405	78.3	7540, 7542, 7550, 7552, 7570, 7560, 7590, 7600
406	45.0	7440, 7450, 7460, 7530, 7580

Source: Burns 1997. Data derived from GIS data base.

Major Habitat Categories

The following categories are types of environment in which a species occurs. The environment can be described in physical or biological terms, which often includes elevation, topography, and type of vegetative community. A species may occupy a range of different habitats or more than one distinct kind of habitat in different seasons. Terrestrial habitats in the Sea Level Project Area include:

- Beach/estuary fringe
- Riparian
- Forest
 - Old-growth forest
 - Young-growth forest
- Alpine/subalpine

A brief description of these habitats follows. Table Wildlife-2 displays an acreage inventory of each habitat by WAA. Note that because several categories overlap each other (e.g., beach fringe may contain some old growth and some riparian habitats), the sum of the total acres will not be the same as the total acreage announced for the Project Area.

Table Wildlife-2
Major Habitat Categories in the Project Area, 1997 (by Wildlife Analysis Area), in Acres*

WAA	1,000-foot Beach Fringe	1,000-foot Estuary Fringe	Riparian Management Area	Forest	Old-Growth Forest	Young-Growth Forest	Subalpine/Alpine
405	4,149	3,049	4,946	33,014	30,574	2,639	256
406	5,660	3,264	9,907	54,451	44,689	9,563	5,378
Total	9,809	6,313	14,853	87,465	75,263	12,202	5,634

* Certain use areas overlap. For example, old-growth and young-growth forest are also included in beach and estuary fringe habitats.

Beach Fringe

For the purposes of this analysis, beach fringe is the land within 1,000 feet of the mean high tide and includes estuarine habitats. Areas within 1,000 feet of the ocean shoreline are transitional zones between land and water, salt and freshwater, and vegetated and nonvegetated conditions (USDA Forest Service 1979a). Forested areas in this transitional zone are heavily used by species with high economic, recreational, subsistence, or aesthetic values. Black bear, river otter, bald eagle, marten, Sitka black-tailed deer, and Vancouver Canada goose concentrate their activities during some seasons in these forest stands. Past

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timber harvest activity was concentrated in this habitat. No alternatives in the Sea Level EIS propose any additional timber harvest within beach fringe.

Estuary Fringe

Estuary fringe habitat is a 1,000-foot zone around estuaries. Bears, waterfowl, furbearers, and eagles are the primary users of the estuary fringe habitat. The estuary fringe is similar to beach fringe, but because of species diversity, it has a greater value to wildlife, especially black bears, river otters, mink, bald eagles, and waterfowl. No harvest is proposed within the estuary fringe.

Riparian

The riparian habitat is recognized as some of the most productive wildlife habitat in Southeast Alaska. It occurs along rivers and streams or around inland lakes, and contains elements of both aquatic and terrestrial ecosystems. Many wildlife species use riparian zones to a much greater extent than other areas (USDA Forest Service 1985), and riparian habitats are extremely important for eagles, furbearers, and black bears (USDA Forest Service 1986). Riparian areas are important migration routes for some wildlife species, and serve as travel routes for numerous species because of the presence of water, food, and cover.

Forest

Forest habitat includes all areas with forest cover, including old growth and second growth described below, and noncommercial forest land as described in the Silviculture and Timber section of this chapter. Many wildlife species, including those associated with old-growth stands, use all forested areas within the Project Area.

Old-Growth Forest

Old-growth forest is characterized by stands of trees usually well past the age of maturity with declining growth rates and signs of decadence, such as dead and dying trees, snags, and downed woody material. The stand usually includes large diameter trees, multi-layered canopies, a range of tree diameter sizes, and the notable presence of understory vegetation. These and other characteristics make old-growth forests important habitat for Sitka black-tailed deer, martens, black bears, and cavity nesting birds such as the hairy woodpecker. These forests are in a dynamic, steady state where the death of old trees is balanced by the growth of new trees. This category of old growth also includes the unproductive forest as well as the productive commercial forest lands. Old-growth forest acres are also included in beach fringe, estuary fringe, riparian, and other habitat areas. For a more detailed discussion of old-growth vegetation, see the Silviculture and Timber section and the Biodiversity section of this chapter.

Young-Growth Forest

Young-growth forest is defined for the purposes of this section as consisting mostly of areas that have been harvested. Large-scale young-growth stands are of lower value to wildlife such as deer, martens, bears, and cavity nesters. Conifer seedlings aggressively invade and eventually shade out desirable herbaceous vegetation and provide fewer trees and snags suitable for excavation by woodpeckers and other cavity users. This habitat type was inventoried to help display the amount of past timber harvest activity that has occurred within the Sea Level Project Area. Some young-growth forest has been created naturally by windthrow, landslides, and avalanches.

Alpine/Subalpine

The alpine/subalpine category includes all sites at or above treeline, including open meadows of grasses, forbs, and shrubs; and scrub forest (Sidle and Suring 1986). Subalpine habitat includes a mosaic of forested, scrub, and nonforested sites that occur at higher elevation than the upland forest, at the lower edge of the alpine zone (Sidle and Suring 1986).

Wildlife Habitat Capability Models

Alpine/subalpine habitat within the Sea Level Project Area is generally above 1,500 feet in elevation. These habitats are important summer foraging areas for deer and black bears.

Wildlife models were used to calculate habitat capability for deer, marten and wolf in the Project Area. For specific information on the models used, see Suring (1988) for marten and wolf, and the TLMP (1997) for deer. Because of the amount of timber harvest on non-National Forest System lands throughout the Ketchikan Administrative Area, a maximum potential impact was assumed, and no habitat capability was calculated for State and private lands.

The terms "habitat capability" and "populations" are not interchangeable. Habitat capability is synonymous with carrying capacity or the estimated number of animals the habitat can support through the most critical period of the year. Population is the estimated number of animals actually present at a given time. Populations may temporarily exceed habitat capability (for example, due to a series of mild winters). However, populations may be below what the habitat is capable of producing, due to predation, winter mortality, or other ecological factors in some years.

Given data limitations, the complexity of ecological relationships, and the need to simplify variables for use in the models, actual population sizes in some areas may vary considerably from those predicted by the analysis. However, the procedures provide estimates of habitat capability that over time are expected to be a reasonable indicator of relative potential impacts and population trends as they relate to the amount and quality of habitat only. Actual populations at any given point in time can be greatly influenced by weather, hunting, trapping, disease, predation, and related factors. Table Wildlife-3 estimates the current wildlife habitat capability in the Project Area.

Table Wildlife-3
Wildlife Habitat Capability Within the Sea Level Project Area

Selected MIS	1999 Habitat Capability
Sitka black-tailed deer	3,794.0
Marten	164.0
Gray wolf	11.0

Source: Burns 1999. Data derived from GIS data base and interagency habitat capability model for # of animals.

Deer and wolf habitat capability is higher than that shown in the Draft EIS. There are two main reasons for this change. First, in the Draft EIS we used the Deer Habitat Capability Model from the Draft TLMP Revision. In the Final EIS we used the Deer Habitat Capability Model from the Final TLMP Revision (1997). The Final TLMP model assigned higher Habitat Suitability Index (HSI) values to old growth forests and lower values to clearcut areas. This was done to more adequately reflect deer density related to HSI values. Secondly, in the Sea Level Draft EIS, the Habitat Suitability scores were transformed into "numbers" of deer (for planning purposes only) by multiplying the habitat scores by a maximum long term carrying capacity of 100 deer per square mile for an HSI score of 1.0. In the Sea Level Final EIS we used 125 deer per square mile as recommended by the interagency deer habitat modeling workshop (DeGayner 1996) and TLMP (1997). These two factors increased the model output for the Sea Level Final EIS.

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Management Indicator Species

Management Indicator Species (MIS) are species of vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities (USDA Forest Service 1982). Through the MIS concept, the total number of species occurring within a Project Area is reduced to a manageable set of species that collectively represent the complex of habitats, species, and associated management concerns. The MIS are used to assess the maintenance of population viability (the ability of a population to sustain itself naturally) and biological diversity and to assess effects on species in public demand (TLMP Final EIS 1997).

The following have been selected as MIS for this Project and will be discussed in detail in this chapter:

Species	Rational for Selection
Sitka black-tailed deer	Important game species
marten	Old growth; important furbearer
black bear	Represents estuarine habitat; game species
bald eagle	Old-growth coastline; high public interest
river otter	Represents riparian habitat; furbearer
hairy woodpecker	Cavity excavator
brown creeper	Represents large, high volume, old-growth trees
red squirrel	Utilization of old growth and second growth
Vancouver Canada goose	Represents riparian habitat; game species
gray wolf	Species of concern
mountain goat	Represents cliffs, alpine, subalpine, and old growth

The following species were selected as Tongass National Forest MIS, but have not been selected as MIS for the Sea Level Project:

Species	Rationale for Nonselection
brown bear	Does not normally occur in Project Area
red-breasted sapsucker	Abundant and adaptable in Project Area

Sitka Black-tailed Deer

The Sitka black-tailed deer was chosen as an MIS because it is an important game and subsistence species and is seasonally associated with old-growth forests.

Historically, population fluctuations of Sitka black-tailed deer in Southeast Alaska have been linked with winter severity (Merrian 1970) and predation pressure (Van Ballenberge and Hanley 1984). Deep snow and late springs associated with severe winters have occurred several times in the past 80 years. Deer die-offs are common during severe winters, even in the best old-growth winter ranges. Predators of deer, such as gray wolves, bears, and hunters, can also contribute to the population decline during these winters, inhibiting subsequent recovery of the deer population. In general, winter severity increases with latitude and with a decreased maritime influence in Southeast Alaska (Longhurst and Robinette 1981).

Research conducted throughout Southeast Alaska indicates that high-volume, old-growth forests at lower elevations are essential to maintaining a sustainable deer population during severe winters (Schoen et al. 1985; Hanley and Rose 1987; Yeo and Peek 1992). Large, strong branches, characteristics of the old-growth stands, intercept snow, providing for deer mobility while maintaining available forage. High-volume stands of old-growth forests support adequate herb and shrub layers of deer forage. In most cases, timber harvest of deer

winter range reduces the long-term quality of deer winter range. Effects on deer populations are compounded by the combination of deep-snow winters and large amounts of deer winter range converted to second growth. Snow significantly reduces forage availability in clearcuts during the winter. Closed canopy young-growth stands provide little forage in winter or summer. The amount of young growth and winter severity are key factors in determining the capability of the land to support deer populations.

An interagency model (Suring et al. 1992) was developed to evaluate the potential quality of winter habitat for Sitka black-tailed deer. The model was updated for the TLMP (1997). Analysis for the Sea Level Project uses the updated model the TLMP (1997) used in its analysis. This was based on various parameters, including snow depth, aspect, elevation, and whether areas have been harvested.

Results of the deer model indicates there is a habitat capability for approximately 3,794 deer in the Sea Level Project Area (Table Wildlife-3). Table Wildlife-4 shows habitat capability in the Project Area at current conditions and before 1954.

Table Wildlife-4
Deer Habitat Capability for 1954 and 1999 for the Entire WAA

	1954 Habitat Capability	1999 Habitat Capability	Percent Change
Sea Level Project Area	5,677	3,794	-33.2

Source: Burns 1999. Data derived from GIS data base and Sitka black-tailed Deer Habitat Capability Model, TLMP 1997.

The best deer habitat in the Project Area appears to be in the Sea Level Creek area on the east side of Thorne Arm. Field crews reported a high occurrence of deer sign including many beds and trails. Field crews also reported a high number of wolf sightings in this area.

Other areas with good deer winter habitat include the head of Thorne Arm, the beach fringe south of Shoal Cove, the beach fringe north of Calamity Creek in Carroll Inlet, and the area surrounding Gnat Cove in Carroll Inlet.

Marten

The marten was selected as an MIS to represent old-growth associated species and because it is an important furbearer. Marten populations are moderate in the Project Area. High pelt prices, susceptibility to trapping pressure, and liberal trapping regulations have created a large demand for marten.

Martens prefer mature old-growth forests with a well developed overhead canopy. Snags and downed woody debris are important to martens for winter and summer dens and resting sites and cover habitat for prey species. The distribution and abundance of martens is determined to a large extent by the availability of cover and the presence of prey species (Simon 1980).

Throughout the year, especially in the winter, small mammals are an important food source for martens. During the summer their diet is supplemented by birds, insects, fruits, and berries.

The Habitat Capability Model was developed to evaluate the potential quality of winter habitat for the marten (Suring et al. 1988a). The underlying assumption is that if adequate winter habitat is available, habitat requirements throughout the rest of the year will not be limited. The model incorporated the following factors in the analysis: (1) classes of timber

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volume in old-growth forests, (2) stand size classes [stand age], (3) beach fringe habitat, (4) riparian habitat, (5) elevation, and (6) old-growth patch size.

The marten model indicates there is habitat capability for an estimated 164.0 marten in the Sea Level Project Area (Table Wildlife-3).

The TLMP (1997) identified high-value marten habitat as stands below 1,500 feet elevation in high-volume productive old-growth strata. There are approximately 19,821 acres of high-value marten habitat in the Project Area as defined in the TLMP.

Black Bear

The black bear was selected as an MIS to represent estuarine habitat and because it is an important game species. Black bears occur throughout the Project Area, and populations are currently stable. As of the 1990/91 black bear harvest season, nonresident hunters have been limited to one black bear, while Alaska residents may harvest two black bears.

Black bears are highly adaptable and can tolerate moderate disturbances, such as habitat alteration, as long as the basic requirements for food and cover are satisfied (Lawrence 1979). As clearcut stands mature, both forage resources and numbers of denning sites may decline.

After emergence from dens in the spring, black bears seek sources of new plant growth for food (Mondafferri 1982). Grass flats of estuaries, low elevation forests near the beach (beach fringe habitats), and avalanche slopes provide the needed high-quality forage. Estuaries like those in Gnat Cove, Shoal Cove, and near the head of Thorne Arm receive frequent use. During the summer, black bears feed on forbs, berries, and salmon. In the fall they feed on berries and forbs (Sidle and Suring 1986) in the subalpine areas.

Bear den sites include: (1) cavities in trees and stumps, (2) caves, and (3) excavated and natural depressions under tree roots, stumps, and fallen logs. Black bears search for food in clearcuts that provide access to cover, which is found in mature and old-growth forests. Clearcuts 10 to 15 years old are preferred because of the production of large amounts of berries (Lindzey and Menslow 1977).

Bald Eagle

The bald eagle was selected as an MIS because the public has a strong interest in the species and the species has special habitat requirements. Bald eagle habitat is defined as beach fringe habitat. The majority of eagles in Southeast Alaska nest in coniferous forest habitats along the coastline and associated saltwater inlets (Suring et al. 1988c). Eagles prefer to nest in continuous stands of old growth rather than in narrow leave strips of old-growth trees. Of the 3,850 nests surveyed in Southeast Alaska, 92 percent were within 300 feet of the shoreline (Hodges and Robards 1982).

Bald eagles nest adjacent to the habitat that provide the best opportunities for foraging or searching for food, such as over open water and on tidal flats. Eagles primarily feed on fish, but are also known to feed on waterbirds, marine invertebrates, and drifting carrion. Perching sites near the nest and foraging areas are also important components of bald eagle habitat. The bald eagle and its habitat have been given special protection through the Bald Eagle Protection Act as implemented by an Interagency Agreement between the Forest Service and the U.S. Fish and Wildlife Service (USDA Forest Service and USDI Fish and Wildlife Service 1990). Among the provisions of the Interagency Agreement are: requirement of a 330-foot vegetation protection buffer around eagle nests, timing restrictions for blasting within 1/2 mile of known nests, and a requirement that formal consultation with the U.S. Fish and Wildlife Service take place when any portion of the agreement cannot be implemented.

The U.S. Fish and Wildlife Service has identified 60 nest sites in the Sea Level Project Area. During field inventories, four new nests were found in Thorne Arm. Table Wildlife-5 displays the number of identified eagle nests which occur in each WAA.

Table Wildlife-5
Number of Eagle Nests by WAA in the Sea Level Project Area

WAA	# Nests
405	38
406	26
Total	64

Source: Burns 1997. Data derived from GIS data base.

Most bald eagle nesting habitat is protected under the Forest-wide standards and guidelines (TLMP 1997) with the 1,000-foot beach and estuary buffers. The Sea Level Project incorporates these standards and guidelines in all alternatives.

River Otter

The river otter was selected as an MIS to represent riparian habitats and because it is an important furbearer. River otters concentrate along intertidal zones and the adjacent narrow beach fringe. They also travel extensively throughout streamside habitats. The old-growth forests in Southeast Alaska are assumed to provide optimum habitat for river otters (Suring et al. 1988d), with seedling and sapling (i.e. clearcut) and pole timber stands providing limited habitat. Otters avoid clearcuts extending to the beach in Southeast Alaska (Larsen 1983) because of lack of cover and density of shrub growth. High value otter habitat must provide adequate shelter in addition to sufficient food (Melquist and Hornocker 1983). River otters feed on fish (primarily sculpins and rockfish), crabs, and occasional invertebrates other than crabs (Sidle and Suring 1986).

River otters depend on large woody debris (LWD) in streamside, lakeside, and beach habitats. The large extensive root systems, downed tree trunks, and overturned root wads of old-growth trees create undercuts and hollows that maintain den and resting sites, and cover. From May through July, female otters use old-growth habitats near streams for inland dens (up to 0.5 miles from the coastline). The annual harvest of river otter on the Tongass National Forest has varied from a high in 1979-80 of 652 animals, to a low of 373 animals in the 1986-87 harvest season. Harvest numbers are a function of both otter abundance and trapper effort.

Red Squirrel

Optimum habitat for red squirrels provides opportunities for food sources, food caching sites, and nesting cover (Vahle and Patton 1983). This includes forested stands with two or more species of conifers of cone-bearing age for food, snags for den sites, and downed logs for cache sites. These conditions are best provided in old-growth Sitka spruce forests in Southeast Alaska. Other forest types provide life requirements of red squirrels, but food resources are not as plentiful as they are in spruce forests. Red squirrels represent a species that can survive fairly well in second-growth timber stands at seed-producing age.

Hairy Woodpecker

The hairy woodpecker was chosen as an MIS representing cavity users because of its preference for stands of old-growth western hemlock and Sitka spruce, and for its association with snags (standing dead trees). Hairy woodpeckers are year-round residents in Southeast

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Alaska and use snags and partially dead trees for nesting and foraging. These woodpeckers feed on larvae of wood-boring beetles, other insects, and seeds and berries in winter (Sidle and Suring 1986).

The hairy woodpecker is important as a primary cavity excavator because by drilling holes in trees it creates habitat needed for other wildlife species (Kessler 1979; Noble and Harrington 1977). Forty-two species of mammals and birds in Southeast Alaska nest or den in tree cavities, including woodpeckers, owls, hawks, waterfowl, bats, squirrels, martens, and otters. Several of these species depend exclusively on cavities in the large diameter snags characteristic of old-growth stands for nest and den sites. Most cavity nesting or denning species would be represented by hairy woodpeckers and respond similarly to proposed activities.

Hairy woodpecker habitat is defined as high volume stands below the subalpine category. Availability of suitable winter habitat for roosting and foraging is considered an important constraint on the habitat suitability of the hairy woodpecker.

Brown Creeper

The brown creeper was chosen as an MIS because it is associated with large, old-age trees and represents the old-growth forest community. Brown creepers and other bark foraging birds also select larger diameter trees as foraging sites during cold, windy weather to lessen their exposure (Grubb 1975, Webber 1986). The diet of brown creepers consists of larvae, pupae, and eggs of insects gleaned from the crevices of bark, spiders, other small invertebrates, and occasionally seeds (Pearson 1923, Reilly 1968). Large diameter trees are preferred because a bird can feed longer on a large tree and capture more prey per visit (Airola and Barrett 1985).

The abundance of large coarse-barked trees and the length of the vertical foraging height appears to affect the territory size (Apfelbaum and Hanley 1977); the area necessary to support the birds increases as the number of large, tall trees decreases. Brown creepers spend most of their time foraging on live parts of trees rather than dead trees (Morrison et al. 1987).

Slightly more than one tenth of the number of brown creepers observed in stands with 30,000 board feet per acre were observed in stands with 20-30,000 board feet per acre (Hughes 1985). Other habitats in Southeast Alaska were not considered to provide suitable habitat for brown creepers.

Vancouver Canada Goose

The Vancouver Canada goose was selected as an MIS to represent old-growth and riparian habitats. The Vancouver Canada goose is also a game species.

Banding studies have indicated Vancouver Canada geese are primarily nonmigratory (Ratti and Timm 1979) and are found almost exclusively in Southeast Alaska. These geese use forested habitats for nesting and brood rearing; they place nests in trees, use trees for perches during incubation, and rely primarily on forest understory plant species for food during this part of their life cycle (Doyle et al. 1988). Lebeda and Ratti (1983) suggest that the three most important factors for nesting Vancouver Canada geese are: (1) dense understory vegetation, (2) forest surrounding surface water, and (3) an abundant food source.

Gray Wolf (Alexander Archipelago Wolf)

The gray wolf was selected as an MIS because of public concerns over what effects additional timber harvest and higher road densities would have on the wolf population within the Sea Level Project Area. Wolf sign has been observed throughout the Project Area. Pack home range and numbers are not known.

The Alexander Archipelago wolf is a small subspecies of the gray wolf (Goldman 1937, Pederson 1982), similar in appearance to the Vancouver Island wolf.

On December 17, 1993, the US Fish and Wildlife Service (USFWS) received a petition from the Biodiversity Legal Foundation to list the Alexander Archipelago wolf of Southeast Alaska as threatened pursuant to the Endangered Species Act. On May 13, 1994, the USFWS found that the petitioners had presented substantial information indicating that listing may be warranted and a status review of the species was initiated. On February 16, 1995, the USFWS determined that listing was not warranted. Since that time the courts directed the USFWS to reconsider their determination. The USFWS recently determined that the wolf did not warrant listing.

The primary food of most Southeast Alaskan wolves is deer (Wood 1990, Person 1993). Beaver, mountain goat, and moose are also primary prey in some mainland areas and spawning salmon are fed on when available (Wood 1990).

Based on field observations, discussions with trappers, and anecdotal information, the wolf population in Southeast Alaska was estimated to be 635 to 690 individuals, distributed in 85 packs (Morgan 1990). However, Person et al. (1996) estimates the current Southeast population at about 908 individuals with about 20 percent of them occurring in Game Management Unit (GMU) 1A (Revillagigedo Island and surrounding mainland). The Sea Level Project contains portions of Wildlife Analysis Areas (WAA) 405 and 406, which are included in GMU 1A.

A 1984-85 wolf study (Smith et al. 1985) suspected that there were eight packs of wolves on Revillagigedo Island with an early winter population of 29 to 51 and 26 to 37 in spring.

Application of the Tongass habitat capability model indicates there is a habitat capability for an estimated 11 wolves in the Sea Level Project Area (Table Wildlife-3).

Habitat most valuable to deer during the winter period is characterized by low elevation mature forest on south facing slopes. We conducted an analysis on the amount of low elevation (<800 feet) productive old-growth forest (>8,000 MBF/acre) on south facing slopes (135 degrees to 225 degrees). The results are displayed later in this section under Effects of the Alternatives.

Many studies have shown that wolf abundance may be inversely correlated with road density (Theil 1985, Jensen et al. 1986, Mech et al. 1988, Fuller 1989, Person et al. 1996). Person et al. (1996) noted that wolf harvest rates increased sharply in Wildlife Analysis Areas on Prince of Wales Island where road density exceeded 0.49 miles per square mile. The TLMP recommends maintaining open road densities below the threshold of 0.7 mi/sq mi to help protect wolf populations from over-harvest. This recommendation is based on the work in Person et al. (1996). The primary threat of high road densities is the increased access to humans who kill wolves by shooting, snaring, or trapping (Van Ballenberghe et al. 1975, Mech 1977).

There has been an increase in road density associated with logging activities. Total road density is currently about 1.08 miles per square mile for the Project Area. About 16 miles of road have been blocked to car and truck access. Open road density is currently approximately 0.97 miles per square mile across the Project Area. Most of these roads are not connected to the Ketchikan road system.

Mountain Goat

Mountain goats represent species using cliffs, alpine and subalpine, and old-growth forest habitats. Hunted populations are sensitive to overharvest and human disturbance. The quality and quantity of winter habitat is the most limiting factor for mountain goats in Southeast Alaska. Old-growth trees with large dense crowns have the highest value because they

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intercept the most snow and provide understory forage plants. Lack of snow interception in early successional stages, and lack of forage in middle successional stages, reduces their value as habitat (TLMP Final EIS (1997)).

Mountain goats have been introduced onto Revilla Island over the past 15 years. A substantial population now exists near Mount Reid, just north of the Project Area. The population ranges from the ridge above Swan Lake north to the ridge above Orchard Lake. A few goats may range as far south as the head of Calamity Creek.

Suring et al. (1988f) identified productive old growth near escape terrain as the most important winter habitat. The primary factors in evaluating goat habitat is its proximity to escape terrain and availability of food. Winter habitat is identified as old-growth forest habitat in close proximity to steep cliffs and steep, rocky slopes that provide escape terrain.

Endemic Terrestrial Small Mammals

The Forest Plan (1997) contains standards and guidelines for managing endemic small mammals. The objective of the small mammal Standard & Guidelines is to maintain habitat to support viable populations and improve knowledge of habitat of rare or endemic terrestrial mammals that may represent unique populations with restricted ranges (Forest Plan 1997). TLMP directs us to conduct surveys on islands larger than 50,000 acres (Revillagigedo Island) if there is a high likelihood that endemic taxa are present that may be affected by the proposed project.

There is one endemic taxa that possibly occurs within the Sea Level Project. MacDonald and Cook (1994) list a subspecies of southern red-backed vole (*Clethrionomys gapperi solus* Hall and Cockrum) that occurs on Revillagigedo Island. This is a different subspecies than those on Cleveland Peninsula and the southern Southeast Alaska mainland. MacDonald and Cook (1994) concluded that red-backed voles were ubiquitous with generalized habitat requirements.

Effects of the Alternatives

Direct and Indirect Effects

This analysis considers the direct, indirect, and cumulative effects of timber management in the Project Area. Direct effects are projected to 1999, the anticipated end of the current proposed action; to 2007, which includes the reasonably foreseeable future; and to 2095, to show the cumulative impacts of harvesting all the suitable lands through the first 100 years.

Effects on Wildlife Habitat

Each action alternative includes harvest of wildlife habitat. Project unit design criteria, BMPs (FSH 2509.22, 1991), and/or legislated protective measures (TTRA) and Forest Standards and Guidelines significantly reduce or eliminate potential impacts to beach fringe, estuary fringe, and riparian habitats in each alternative. Alpine/subalpine (over 1,500 feet elevation) habitat is also affected only slightly in the alternatives by road and unit location because of inaccessibility and/or low productivity. Changes throughout the Project Area in these habitats for each alternative are shown in Table Wildlife-6. Impacts to MIS that depend on these habitats are low. Alternative 1, the no-action alternative, will harvest no acreage, with the effect that existing wildlife habitats will remain at current levels, with changes over time due only to natural succession or future timber harvest.

Table Wildlife-6

Proposed Acres for Harvest and Percent Change from 1954 in Wildlife Habitats by Alternative

Habitat Categories	1954 Acres	Existing Acres	Alternative							
			1		2		5		7	
			Acres Cut	Percent Change	Acres Cut	Percent Change	Acres Cut	Percent Change	Acres Cut	Percent Change
Beach Fringe	9,809	7,691	0.0	21.6	0.0	21.6	0.0	21.6	0.0	21.6
Estuary Fringe	6,313	5,058	0.0	19.9	0.0	19.9	0.0	19.9	0.0	19.9
Riparian	14,853	11,751	0.0	20.9	0.0	20.9	0.0	20.9	0.0	20.9
Old-Growth Forest	87,465	75,263	0.0	13.9	2,865.3	17.2	876.5	15.0	1,827.5	16.0
Alpine/Subalpine	5,634	5,297	0.0	6.0	114.0	8.0	12.0	6.2	12.0	6.2

Source: Burns 1998. Data derived from GIS data base.

Beach Fringe

None of the alternatives propose any timber harvest within the 1000-foot beach fringe zone as prescribed in the TLMP (1997).

Estuary Fringe

None of the alternatives were designed to harvest timber within the 1,000-foot estuary fringe zone.

Riparian

For the purpose of this analysis, riparian means the Riparian Management Areas defined as the stream buffers and associated wetlands. No riparian buffers are planned for harvest except unit 128. TTRA buffers, or 100-foot minimum buffers around lakes larger than five acres, are not proposed for harvest.

Forest

Forest sites comprise 87,465 acres, of which 75,263 acres are old-growth forest in the Project Area. Within some harvest units are scattered patches of nonforested or low productivity forest types. The biggest difference among the alternatives is the total number of acres scheduled for harvest for each particular alternative. Alternative 2 proposes to harvest 3.8 percent of the existing old-growth forest. Alternatives 5 and 7 propose to harvest 1.2 and 2.4 percent, respectively. The effects of old-growth habitat loss on old-growth associated species are reflected in Habitat Capability for MIS later in this section. For a discussion of the amount of timber harvest by volume strata, see the Silviculture and Timber section of this chapter.

Alpine/Subalpine

Alternative 2 proposes the most timber harvest (114 acres) in the subalpine habitat. Alternatives 5 and 7 each harvest about 12 acres above 1500 feet elevation.

Effects on Habitat Capability

The previous section discusses changes to wildlife habitats used by the MIS. This section discusses how those changes in habitats affect the potential habitat capability for each MIS. As mentioned in the Affected Environment earlier in this section, the models that estimate the capability of habitats to support selected species are not necessarily accurate reflections of actual populations in the Project Area. Actual population levels are not known for a given period in time

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and probably never will be due to weather, hunting/trapping, disease, predation, and other related factors which are difficult or impossible to predict for any given time in the future.

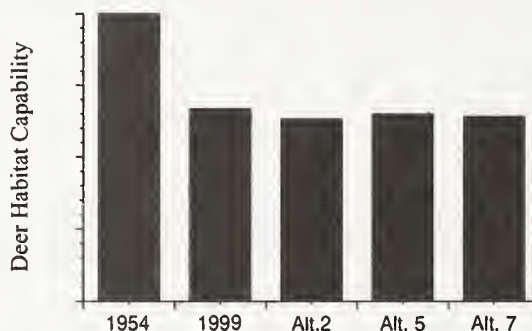
Direct impacts to black bears, otters, and bald eagles have been greatly reduced in all action alternatives through avoidance of timber harvest in beach fringe, estuary fringe, stream corridors, riparian, and alpine/subalpine habitats.

Sitka Black-tailed Deer

Sitka black-tailed deer are dependent on low elevation, high volume, and old-growth stands during severe winters, and are affected by proposed timber harvest under the action alternatives. Alternative 2 would decrease habitat capability 5.4 percent in the Project Area while Alternatives 5 and 7 would decrease habitat capability 2.8 and 4.0 percent, respectively. Figure Wildlife-2 shows the relative habitat capability for deer.

Second-growth canopy closure in timber stands 20 to 30 years after harvest may be delayed by thinning to promote forage production (Hanley et al. 1989). Second-growth forest management has been widely used in Southeast Alaska, but recent research has not documented benefits to Sitka black-tailed deer from thinning and canopy gaps. Potential areas for thinning are listed in Appendix I.

Figure Wildlife-2
Deer Habitat Capability Following Implementation for Each Alternative



Source: Burns 1999. Data derived from GIS database and interagency habitat capability model.

At first glance, Figure Wildlife-2 appears to underestimate the impacts to deer winter habitat. A reduction in habitat capability of only 4 percent from harvesting over 2,000 acres seems low. The relatively low loss of habitat capability is due to the fact that relatively few units are located in high value deer winter habitat. Much of the high and moderate value winter habitat was removed during previous timber harvest operations which harvested much of the habitat at low elevations. This is shown in Table Wildlife-4 as a relatively high amount of habitat capability was lost between 1954 and 1997.

Black Bear

None of the alternatives will threaten black bear population viability. Black bear population viability will be maintained through the application of the Viable Population Strategy outlined in the TLMP (1997).

Effects of Roads

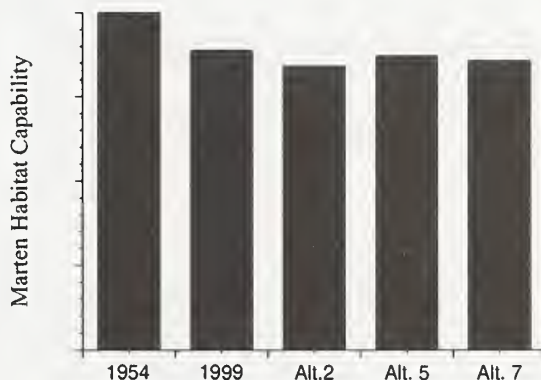
Although black bears can adapt to changes in their environment induced by humans, increased access by humans often leads to increased human-related mortality (legal harvest, poaching, and defense of life and property). The black bear habitat capability model has factors that attempt to take this increased mortality into consideration.

For habitat near a heavily-used transportation system, the habitat capability of the areas within two miles of a road is reduced by 20 percent. For the analysis of the effect of road density, it is assumed that all areas of the Project Area are within 2 miles of a road. Currently, the road systems in the Project Area receive low use. However, road use can be expected to increase as the human population in Southeast Alaska increases. The black bear habitat capability would be reduced by 20 percent as road use increases in the future.

Marten

The marten is an old-growth associated species that uses a wide range of old-growth volume classes, tree species, and landscape zones. Alternative 2 would cause a 5.3 percent decline in habitat capability from existing conditions. Alternatives 5 and 7 would decrease habitat capability by 2.0 and 3.5 percent, respectively (see Figure Wildlife-3).

Figure Wildlife-3
Marten Habitat Capability Following Implementation for Each Alternative



Source: Burns 1999. Data derived from GIS and interagency habitat capability model.
Habitat Capability does not include road effects.

Forest Plan (1997) High-Value Marten Habitat

The TLMP (1997) identified high-value marten habitat as stands below 1,500 feet elevation in high-volume productive old-growth strata. There are approximately 19,821 acres of high-value marten habitat in the Project Area as defined in TLMP. Figure Wildlife-5 shows a comparison of the amount of the TLMP high-value marten habitat harvested under each alternative.

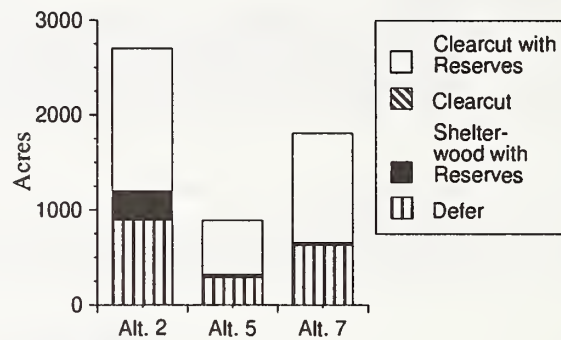
In all alternatives, over half of the TLMP high-value habitat is treated using clearcuts with reserves. About twice as many acres are clearcut as are deferred from harvest (Figure Wildlife-4). Acres with partial-cut treatments fall into two categories. Those in VCUs with

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less than 33 percent of the productive old growth harvested retain 10 to 20 percent of the original stand structure per TLMP Marten Standards And Guidelines.

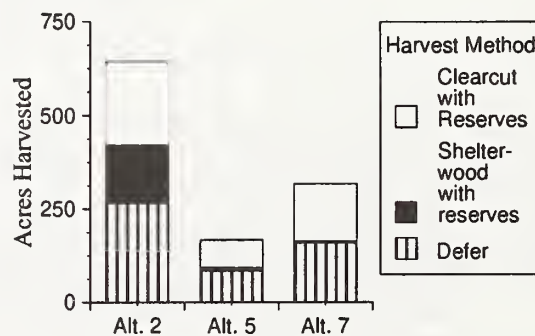
Those VCUs with over 33 percent of the productive old growth harvested retain 30 percent canopy closure to meet TLMP Marten Standards and Guidelines. Clearcuts and reserves in high-value marten habitat are applied in a 1:1 ratio (TPIT direction). One VCU in the Project Area (7560) has over 33 percent of the productive old growth harvested (Figure Wildlife-5).

Figure Wildlife-4
Acres of TLMP High-Value Marten Habitat Treated in the Sea Level Project Area, by Alternative



Source: Burns 1999. Data derived from GIS database.

Figure Wildlife-5
Acres of TLMP High-Value Marten Habitat Treated in VCU 7560, by Alternative



Source: Burns 1999. Data derived from GIS Database.

Road Effects

Marten are easily trapped and can be overharvested, especially where trapping pressure is heavy (Strickland et al. 1982) and not effectively controlled. There is concern that marten densities will decrease (due to their susceptibility to overtrapping) as road densities exceed 0.2 miles of road per square mile, and marten densities will be reduced 90 percent as road densities approach 0.6 miles of road per square mile (Suring et al. 1992). Currently, none of the roads are connected to Ketchikan. Current road use and marten harvest levels are low. Direct impacts are expected to be minimal due to limited access. For more information on marten harvest level, see the Subsistence Section. For information on the proposed Shelter Cove road connection, see Cumulative Effects later in this section, and the Subsistence Section of Chapter 3.

However, future use of Project Area roads may increase as human populations increase in Southeast Alaska and as some of the road systems are connected to the Ketchikan road system. If this happens in the future, then potential cumulative effects could reduce marten habitat capability by as much as 90 percent for Alternative 1, since it has open road densities above 0.6 miles per square mile (Table Wildlife-7). Alternatives 2, 5, and 7 propose to block many of the existing roads and all of the new roads except about 10 miles at Elf Point. Alternatives 2, 5, and 7 would result in road densities below 0.6 miles per square mile.

Viable populations of marten will be maintained through application of the Viable Population Strategy in the TLMP. For further discussion on viable populations, see the Old Growth and Biodiversity section of Chapter 3.

Table Wildlife-7

Marten Habitat Capability in the Sea Level Project Area Adjusted for Open Road Density

	Alternative			
	1	2	5	7
Open Road (miles per square mile)	1.08	0.57	0.5	0.57
Adjustment Factor	0.10	0.8	0.8	0.8
Adjusted Habitat Capability	16.4	110.2	114.1	112.3

Source: Burns 1999.

River Otter

The otter is another species that benefited from measures taken during unit design which limited timber harvest in beach fringe, estuary fringe, stream corridors, and riparian habitat. None of the alternatives are expected to significantly affect otter populations due to implementation of Forest-wide standards and guidelines which protect these habitats.

Red Squirrel

The red squirrel is most successful in old-growth stands. As a worst-case scenario, habitat can be expected to be reduced in proportion to the amount of old-growth forest harvested (Table Wildlife-6). Red squirrels represent a species that can survive fairly well in second-growth timber stands at seed-producing age, so actual effects will probably be somewhat less.

Hairy Woodpecker

The hairy woodpecker is a primary excavator that prefers high volume, old-growth timber, but can also effectively use lower volume stands. Hairy woodpeckers represent cavity and snag-

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dependent species. Hairy woodpeckers may also benefit from snag retention in clearcuts as a mitigation of timber harvest.

Snag Analysis

The TLMP Final EIS (1997) Standards and Guidelines call for maintaining snags and reserve trees to provide habitat for cavity nesting wildlife species. An analysis was completed for all VCUs within the Project Area to determine if prior harvest has reduced the number of snags below Forest Standards and Guidelines.

This analysis was accomplished by using snag densities for the various plant associations that were sampled during stand examinations of units in the unit pool within the Project area. In the evaluations, only snags greater than ten inches DBH were counted. Areas that had been previously harvested were assumed to have one snag per acre. The maximum number of snags per acre assumed to be usable was eight per acre. It was assumed that more than eight snags per acre were in excess of nesting and courtship needs of the hairy woodpecker, which was the MIS chosen to represent cavity dwellers and users of snags for the Sea Level Project Area. Average snag densities were greater than eight snags/acre for all plant associations.

The analysis indicates that there is an adequate number of snags existing in all VCUs. All VCUs average at least eight snags per acre. Additionally, all planned harvest units below 1,500 feet elevation in the high volume strata will have at least three snags per acre left to meet marten standards and guidelines. Based on this information, snag habitat for hairy woodpeckers and other snag dependant species will be maintained throughout the Project Area.

Brown Creeper

The brown creeper prefers large old-growth trees. Brown creeper habitat can be expected to decline approximately proportional to the amount of old-growth forest harvested by the project. The amount of old-growth forest harvested ranges from none in Alternative 1 to 2,865 in Alternative 2 (Table Wildlife-6). This translates to a 15 percent reduction from 1954 conditions for Alternative 1 and an 18 percent reduction for Alternative 2.

Vancouver Canada Goose

The Vancouver Canada goose nests in forested areas in proximity to open water and preferred food plants. Forest-wide standards and guidelines (TLMP 1997) incorporated into this project protect estuary, beach, stream and lake buffers. Application of these standards and guidelines will protect most goose habitat. None of the alternatives harvest in these habitats. Forest-wide standards and guidelines for waterfowl management include providing a minimum distance of 330 feet between human activities and significant waterfowl areas. This, combined with the beach and estuary buffers, will protect significant waterfowl areas.

Bald Eagle

Scheduling development activities away from beach fringe, estuary fringe, lake buffers, and Class I and II streams will effectively reduce impacts to bald eagle nesting habitat. No decrease in nesting habitat capability is predicted for any alternatives. Management activities within 1/2 mile of an eagle nest site are restricted by an Interagency Agreement between the Forest Service and the U.S. Fish and Wildlife Service (USDA Forest Service and USDI Fish and Wildlife Service 1990). Blasting, usually associated with road building, is prohibited within 0.5 miles of active bald eagle nests during the nesting period. All nests are considered active from March 1 to May 31. Nests are considered active from June 1 to August 31 if nesting adult pairs, eggs, or young eagles are present. The following units in the Sea Level Project are within 1/2 mile of known bald eagle nests.

Table Wildlife-8
Units within 0.5 miles of Bald Eagle Nests in the Sea Level Project Area

Unit Number	Alternative			
	1	2	5	7
1		x	x	x
24		x	x	
33		x		x
36		x		x
42		x	x	x
43		x		x
44		x		x
80		x		x
88			x	x
113		x		x
118		x		x
119		x		x
120		x		x
141		x		x
165		x		
166		x		
216		x		
217		x		x
218		x		
238		x		
239		x		

Source: Burns 1999. Data derived from GIS database.

The interagency agreement also establishes a 330-foot buffer zone around each nest where disturbance activities are prohibited. None of the alternatives propose harvest within the 330-foot buffer zone. This is mainly due to the establishment of the 1000-foot beach and estuary buffers.

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Table Wildlife-9

Roads with Construction within 0.5 miles of Bald Eagle Nests in the Sea Level Project Area

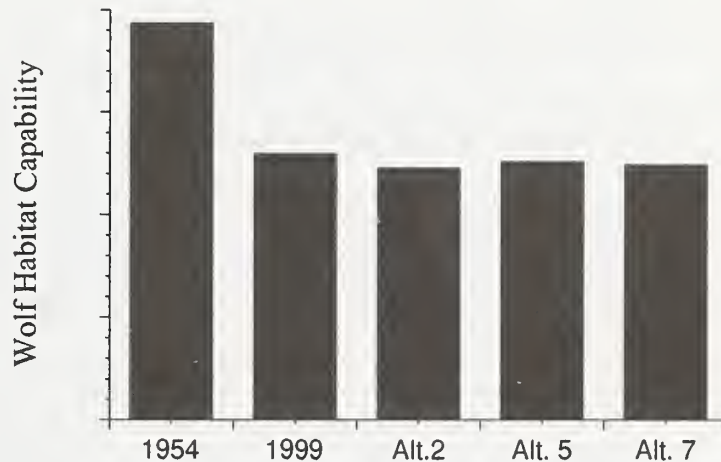
Road Number	Alternative			
	1	2	5	7
8340000-2		X	X	X
8340295		X		X
8400000		X		X
8400180		X		X
8400280		X		X
8400285		X		X
8400425		X	X	X
8430000		X		X
8430250		X	X	
8430290		X		X
8445000		X	X	X
8445100			X	X

Source: Burns 1999. Data derived from GIS database.

Alexander Archipelago Wolf Habitat Capability

The gray wolf habitat capability model runs off the Sitka black-tailed deer habitat capability model, since there are not any significant numbers of moose or mountain goats in the Project Area. None of the action alternatives influence the deer numbers enough to show a significant change from the current wolf habitat capability. Figure Wildlife-6 shows the relative wolf habitat capability for each alternative. The habitat capability does not include the effects of road density, due to the fact that all the road systems are isolated and not connected to any large population centers. The Cumulative Effects section includes a discussion of effects that might be anticipated if project and Ketchikan road systems are connected.

Figure Wildlife-6
Wolf Habitat Capability Following Implementation for Each Alternative



Source: Data derived from GIS database.

Implementing any of the Project action alternatives will result in a reduction in deer habitat capability. Wolf habitat capability is predicted to be reduced in proportion to the reduction in deer habitat capability. The wolf habitat capability reduction is predicted to range from 0.0 percent for Alternative 1 to 5.3 percent for Alternative 2 (Table Wildlife-11). Alternatives 5 and 7 would reduce the habitat capability by 2.8 and 4.0 percent, respectively.

Deer and wolf habitat capability is higher than that shown in the Draft EIS. There are two main reasons for this change. First, in the Draft EIS we used the Deer Habitat Capability Model from the Draft TLMP Revision. In the Final EIS we used the Deer Habitat Capability Model from the Final TLMP Revision (1997). The Final TLMP model assigned higher Habitat Suitability Index (HSI) values to old-growth forests and lower values to clearcut areas. This was done to more adequately reflect deer density related to HSI values. Secondly, in the Sea Level Draft EIS, the Habitat Suitability scores were transformed into "numbers" of deer (for planning purposes only) by multiplying the habitat scores by a

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maximum long term carrying capacity of 100 deer per square mile for an HSI score of 1.0. In the Sea Level Final EIS we used 125 deer per square mile as recommended by the interagency deer habitat modeling workshop (DeGayner 1996) and TLMP (1997). These two factors increased the model output for the Sea Level Final EIS.

Deer Habitat and Deer Density

This section discusses the relationship between deer habitat, deer population levels, and wolf population levels. Deer are the primary prey species for wolves in WAAs 405 and 406.

Habitat most valuable to deer during the winter period is characterized by low elevation mature forest on south facing slopes. We conducted an analysis on the amount of low elevation (<800 feet) productive old-growth forest (>8,000 MBF/acre) on south facing slopes (135 degrees to 225 degrees). There are approximately 6,858 acres meeting these criteria within the Sea Level Project Area. This is about 83 percent of that which existed prior to extensive logging. These conditions would be maintained under Alternative 1. Alternative 2 would decrease this valuable deer habitat to about 71 percent of historical (prior to 1954) conditions. Alternatives 5 and 7 would reduce this habitat to about 79 and 75 percent of historical levels, respectively.

WAA 405 contains about 4,081 acres of mature forest below 800 feet elevation on south facing slopes. This is about 93 percent of historical levels. These conditions would be maintained under Alternative 1. Alternative 2 would decrease this valuable deer habitat to about 83 percent of historical (prior to 1954) conditions. Alternatives 5 and 7 would reduce this habitat to about 92 and 85 percent of historical levels, respectively.

WAA 406 contains about 6,657 acres that meet these criteria, which is about 83 percent of historical conditions. These conditions would be maintained under Alternative 1. Alternative 2 would decrease this valuable deer habitat to about 77 percent of historical (prior to 1954) conditions. Alternatives 5 and 7 would reduce this habitat to about 80 and 78 percent of historical levels, respectively.

The stability of deer and wolf populations depends on several factors, including predation by wolves, hunters, and other predators. Some of the most important determinants are growth rate and stochastic events such as severe winters. Severe winters or reductions in quality deer habitat can result in widely fluctuating wolf and deer populations. If alternate prey is not available or if the reproductive potential of the deer population is reduced because of habitat loss, then recovery from a population crash could take a long time (Person et al. 1996).

Person et al. (1996) estimates approximately 18 deer per square mile are needed to sustain wolf populations (for a high probability of maintaining viable populations). Falling below this level decreases the probability of maintaining viable populations.

Applying this density to the Sea Level Project Area, about 2,574 deer would be needed to support wolf populations in the Sea Level Project Area. Deer habitat capability is currently about 3,794 deer (27 deer per square mile). This is above what Person et al. (1996) recommends. Alternatives 2 and 7 reduce the deer density to 25 deer per square mile in the Project Area. Alternative 1 (No Action) maintains the deer density at 27 deer per square mile. Alternative 5 reduces the deer density to 26 deer per square mile.

The Project Area is adjacent to the 2.3 million acre Misty Fjords National Monument. This undeveloped area should serve as a supply source for the Project Area as long as connectivity corridors are maintained consistent with TLMP (1997). Alternative 2 harvests timber in identified connecting corridors (unit 60). Alternatives 5 and 7 maintain connectivity.

Roads

Road construction associated with logging activities has increased road densities. Approximately 158 miles of road exist in the Sea Level Project Area within 146 square miles of land (GIS database). Total road density in the Project Area under existing conditions is approximately 1.08 miles of road per square mile.

None of the roads are connected to the Ketchikan road system. The road system in the Project Area receives very little use by trappers and hunters. Most new roads and some existing roads would be closed following project completion.

Table Wildlife-10
Road Density for the Sea Level Project Area, by Alternative

	Alternative			
	1	2	5	7
Total Road (miles per square mile)	1.08	1.51	1.23	1.37
Open Road (miles per square mile)	1.08	0.57	0.50	0.57

Source: Burns 1998. Data derived from GIS database.

Table Wildlife-10 shows the resulting open road densities for the Project Area for each alternative. Alternative 1 (No Action) will maintain the road density in the current level. All action alternatives propose to close many of the existing roads (about 85 miles) and all of the new roads except about 10 miles near Elf Point. All action alternatives in the Sea Level Project maintain road densities below 0.7 miles per square mile (TLMP 1997). All road systems are not currently connected to the Ketchikan road system which will also limit adverse effects.

Summary

Based on the above analysis, direct effects from the Sea Level Project are not expected to threaten wolf populations. The TLMP viable population strategy will be maintained through implementation of all alternatives. This strategy will maintain viable populations of wolves throughout the Project Area.

Most effects on wolves in the Project Area are from past activities. Cumulative effects show reductions in the habitat capability model, and the amount of high-value deer habitat. Deer density in Project Area is 27 deer per square mile, above the 18 deer per square mile recommended by Person et al. (1996) for having a high probability of maintaining viable wolf populations. The Sea Level Project will follow the TLMP strategy for maintaining viable wildlife populations. Old-growth reserves and roadless areas in adjacent Misty Fiords National Monument will serve to maintain wolf population viability. Furthermore, many of the roads potentially connected to the Ketchikan road system will be closed. Open road density will be below 0.7 miles of road per square mile (TLMP 1997) for all alternatives. With these strategies and conditions, the Sea Level Project is not expected to threaten wolf population viability and stability.

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Mountain Goat

Mountain goats are concentrated north of the Project Area, near Mount Reid. A few may come south of Swan Lake and reach the north end of the Project Area.

The alternatives in the Sea Level Project mostly avoid areas adjacent to goat habitat. Goats occur only at the north end of the Project Area, near Swan Lake. All action alternatives could potentially effect goat populations by including Units 83, 88, 89, and 90. These units are closest to the alpine areas where goats would be expected.

Another concern for impacts to mountain goats is hunting pressure from increased access by new road construction. Hunted populations are sensitive to over harvest and human disturbance. Currently, the population on Mount Reid receives limited harvest pressure.

The mainline road along north of Shoal Cove will remain open following project completion. Road access to goat hunting areas will remain at the current condition. Hunters and hikers may still access the high elevation goat habitat by foot, however, the main concentration of goats is still not accessible by road. Based on this information, and the fact that the road system will not be connected to the Ketchikan road system, road effects are expected to be minimal.

Endemic Terrestrial Small Mammals

There is not a high likelihood that endemic taxa will be affected by the Sea Level Project. MacDonald and Cook (1994) concluded that red-backed voles were ubiquitous with generalized habitat requirements. Also, most of Revillagigedo Island will remain as habitat in old growth habitat reserves, beach and estuary buffers, primitive recreation areas, and Misty Fiords National Monument wilderness. Population viability will be maintained through these designations and other Standards and Guidelines in the Forest Plan. The Sea Level Project meets the TLMP objective of maintaining habitat to support viable populations of endemic terrestrial mammals.

Comparison of Alternatives: Summary

Table Wildlife-11 summarizes the habitat capability for each MIS in 1999 and 2003 (when proposed harvesting is expected to be finished). It also includes the percent change from 1999 to 2003.

Table Wildlife-11
Summary of Habitat Capability in the Year 2003 and Percent Change from 1999

Species	1999	Alternative							
		1	Percent Change	2	Percent Change	5	Percent Change	7	Percent Change
Sitka black- tailed deer	3,794.0	3,794.0	0	3,590.0	-5.4	3,686.0	-2.8	3,641.0	-4.0
Marten*	164.0	164.0	0	137.8	-5.3	142.6	-2.0	140.4	-3.5
Gray wolf	11.0	11.0	0	10.4	-5.3	10.7	-2.8	10.6	-4.0

Source : Burns 1999. Data derived from GIS data base and interagency habitat capability models.

* Does not incorporate road density effects.

Cumulative Effects

This portion of the analysis (reasonably foreseeable) will focus on effects to the year 2045. Year 2045 is used to show the impacts after the harvested stands reach the closed canopy stage. Habitat capability was not calculated for State and private lands. This will represent a maximum potential impact, because even if these lands are harvested, they would be providing at least some minimal habitat capability.

Table Wildlife-12 shows the cumulative effects on habitat capability for MIS of the reasonably foreseeable actions from 1954 through 2003 (post Harvest) and 2045 (canopy closure stage). The canopy closure stage is assumed to be the worst case scenario and occurs when all proposed and existing harvest units reach canopy closure and most understory plants are shaded out.

Table Wildlife-12 also displays the impacts of harvesting the scheduled acres of the suitable-available forest lands in the next 100-year planning period (year 2095) and assumes all harvested stands are in the closed canopy, second-growth condition. The figures in Table Wildlife-12 for year 2050 represent the Sea Level units in the canopy closure stage.

Figures Wildlife-7 and Wildlife-8 depict a graphic representation of the decrease in deer and wolf habitat capability for each alternative in 2045, when existing and proposed harvest units would reach the canopy closure stage. Notice the wolf model is almost identical to the deer model. This is to be expected since deer are the main prey item for wolves.

For an analysis of Project Area WAAs through the year 2095, see the TLMP (1997) analysis of deer habitat capability.

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Table Wildlife-12

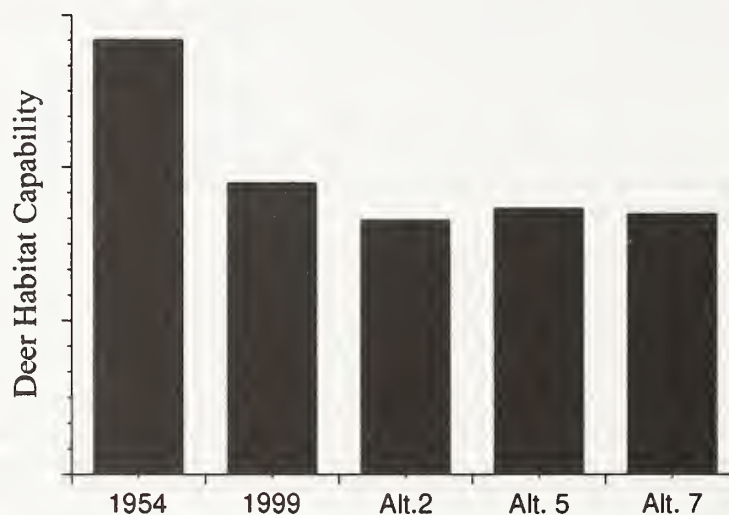
Deer and Wolf Habitat Capability when all Harvested Units Reach the Closed Canopy Stage (2045)

Species	Habitat Capability 1954	Habitat Capability 1999	Percent Reduction from 1954	Alt. 2 (in 2045)	Percent Reduction From 1954	Alt. 5 (in 2045)	Percent Reduction from 1954	Alt. 7 (in 2045)	Percent Reduction From 1954
Sitka black-tailed deer	5,677	3,794	-33.2	3,313	-41.6	3,462	-39.0	3,390	-40.3
gray wolf	16.4	11.0	-33.0	9.6	-41.4	10.1	-38.8	9.8	-40.1

Source: Burns 1999. Data derived from GIS data base and interagency habitat capability models.

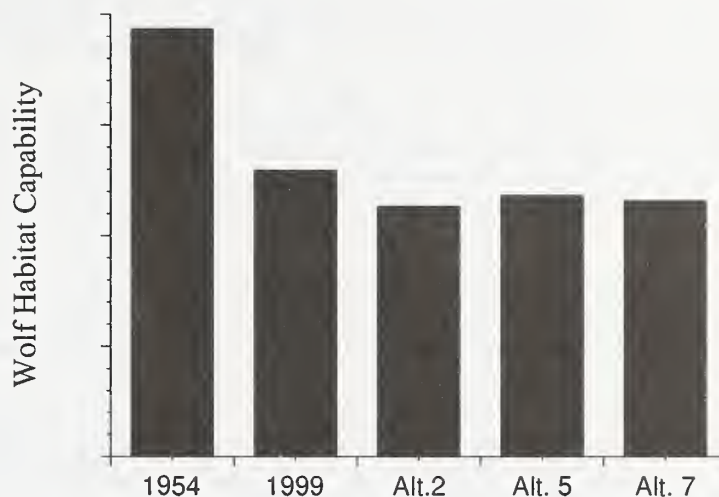
Figure Wildlife-7

Deer Habitat Capability for the Project Area When Harvest Units Reach The Canopy Closure Stage, in Year 2045



Source: Table Wildlife-12. Burns 1999.

Figure Wildlife-8
**Wolf Habitat Capability for the Sea Level Project Area when Harvested
 Units Reach the Canopy Closure Stage, in Year 2045**



Source: Table Wildlife-12. Burns 1999.

Effects on Future Hunting Opportunities

Sport hunting regulations in Alaska are managed by the State and are not the responsibility of the Forest Service. However, it is important to discuss the potential impacts of this project on future hunting opportunities and season and bag limits. Any game law changes must follow the State Board of Game process.

Future hunting opportunities may be reduced in the future due to reduced habitat available to support harvestable populations. While more roads may mean better hunting in the short term, lower quality habitat means lower populations in the long term, which means a lower harvestable surplus of game animals in the long term. For example, if deer hunting pressure continues to increase, at some point demand for deer will exceed the harvestable surplus (supply). Increased restrictions on season and bag limits may be necessary to maintain healthy populations.

The amount of timber harvest increases the risk that sport hunting would have to be restricted sooner in the future. The Alternatives that harvest more timber (Alternative 2) would result in a higher likelihood of hunting restrictions. The No Action Alternative (Alternative 1) has the lowest risk of hunting restrictions. For a discussion of Alaska Department of Game deer, bear, marten and wolf harvest data, see the Subsistence Section in this Chapter.

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Shelter Cove Road Connection

A road connection between Ketchikan and Shelter Cove is being considered as a separate project. This would allow easy access to the Shelter Cove area by Ketchikan residents. This could affect game species such as deer, bear, marten and wolves.

Hunters from Ketchikan could have a significant impact to these game populations in the Shelter Cove area if a road connection were to occur. We are unable to quantify the effects this would have on game populations. Cumulative effects could be substantial in the Shelter Cove area.

Effects of road densities were discussed earlier in this section as they apply to bear, marten and wolves. These effects would occur in the Shelter Cove portion of the Project Area. Based on these discussions, bear habitat capability in the Shelter Cove area could be reduced an additional 20 percent below predicted levels. Marten habitat capability in the Shelter Cove area could be reduced by 90 percent, as shown in Table Wildlife-7, if trapping levels increase.

To mitigate some of the effects, all existing roads except the mainline roads in the Shelter Cove area would be blocked to cars and trucks following project completion. All newly constructed roads would also be blocked to car and truck traffic. Road blocks would consist of physical barriers (tank traps, boulders, etc.) or gated access for administrative purposes, depending on expected future use of the road. Assuming these planned road blocks are successful, they will keep the open-road-density for all alternatives below the 0.7 miles of road per square mile threshold suggested in the TLMP for wolves, and below 0.6 miles per square mile suggested for marten.



AMERICAN MARTIN

Other Environmental Considerations

Probable Adverse Environmental Effects that Cannot be Avoided

Implementation of any action alternative would result in some adverse environmental effects that cannot be effectively mitigated or avoided if the proposed action is to take place. The interdisciplinary procedure used to identify specific harvest units and roads was designed to eliminate or lessen the significant adverse consequences. In addition, the application of standards and guidelines, BMPs, mitigation measures, and a monitoring plan are intended to further limit the extent, severity, and duration of these effects. The specific environmental effects of the alternatives were discussed earlier in this chapter, and mitigation measures are described in Chapter 2. Although the formulation of alternatives included avoidance of potentially adverse environmental effects, some adverse impacts to the environment which cannot be completely mitigated may occur.

Although standards and guidelines, BMPs, and monitoring plans are designed to prevent significant adverse effects to soil and water, the potential for adverse impacts does exist. Sediment production would occur as long as roads are being built and timber is harvested. Sediment would be produced by surface erosion, channel erosion, and mass movement.

Disturbance, displacement, or loss of fish and wildlife may occur as a consequence of habitat loss and increased human activity in the Project Area. New road construction and the human activities associated with new access to areas previously unroaded would result in impacts to fish and wildlife. Improved access into areas that previously had limited roads would have similar effects.

Ground-disturbing activities could temporarily increase sediment loads in some streams. This could displace fish, reduce anadromous and resident fish reproductive success, and alter aquatic invertebrate populations. The portion of a stream bed occupied by a culvert or other crossing structure would be lost as fish habitat.

Both the amount and distribution of mature and old-growth stands would be reduced through implementation of any action alternative. The rate and severity of adverse impacts varies by alternative. Because some wildlife species rely on habitat conditions provided by old-growth stands, the reduction in the populations of some wildlife species can be expected. As old-growth and mature timber stands are converted to young even-aged stands, the capability of the Project Area to provide optimal habitat for old-growth dependent species would be reduced.

Timber harvest and road construction in areas that are currently unroaded would alter natural characteristics of these areas. This would modify the recreational experiences that are offered by these areas. Both primitive and semi-primitive recreation opportunities will be lost by these actions. In addition, these development activities would result in a loss of opportunity to consider these areas in future revisions of the Forest Plan for designation as wilderness, as roadless areas, research natural areas, or for other purposes requiring natural characteristics.

The natural landscape would appear visually altered by timber harvest, roads, and structures particularly where logging activity is visible from travel routes and use areas. These adverse effects would eventually be mitigated by natural regrowth of vegetation. Other impacts on the natural appearance of the landscape include roads and structures which are highly visible despite efforts to blend them with landforms and vegetative and locational mitigation.

The intensity and duration of these effects depends on the alternative and the mitigation measures applied to protect the resources. Most unavoidable effects are expected to be short term (usually less than 2 to 5 years). In all cases, the effects would be managed to comply with established legal limits, such as maximum time for regeneration. To reduce these

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Relationship Between Short-Term Uses and Long-Term Productivity

effects, monitoring procedures and mitigation measures have been planned for those areas which may be affected. Specific mitigation measures are documented in the unit and road cards.

Some adverse effects are of a transitory type. For example, air quality may diminish on a recurring, though temporary, basis due to road construction, timber harvest, timber hauling and recreation traffic on untreated roads, and due to the operation of internal combustion engines. Where they occur, these activities may have localized temporary adverse effects on air quality.

All alternatives would come under the mandate of the Multiple Use and Sustained Yield Act of 1960, which requires the Forest Service to manage Forest System lands for multiple uses (including timber, recreation, fish and wildlife, range, and watershed). All renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be reestablished and grown again if the productivity of the land is not impaired.

Maintaining the productivity of the land is a complex, long-term objective. All alternatives protect the long-term productivity of the Project Area through the use of specific standards and guidelines, mitigative measures, and BMPs. Long-term productivity could change as a result of various management activities proposed in the alternatives. Timber management activities would have direct, indirect, and cumulative effects on the economic, social, and biological environment.

Soil and water are two key factors in ecosystem productivity, and these resources would be protected in all alternatives to avoid damage that could take many decades to rectify. Sustained yield of timber, wildlife habitat, and other renewable resources all rely on maintaining long-term soil productivity. Quality and quantity of water from the Project Area may fluctuate as a result of short-term uses, but no long-term effects to the water resource are expected to occur as a result of timber management activities.

All alternatives would provide the fish and wildlife habitat necessary to contribute to the maintenance of viable, well-distributed populations of existing native and desired non-native vertebrate species. The abundance and diversity of wildlife species depends on the quality, quantity, and distribution of habitat, whether used for breeding, feeding, or resting. Management Indicator Species (MIS) are used to represent the habitat requirements of all fish and wildlife species found in the Project Area. By managing habitats and populations of indicator species, the other species associated with the same habitat would also benefit. The alternatives provide standards, guidelines, and mitigation measures for maintaining long-term habitat and species productivity. The alternatives vary in the risk presented to both wildlife habitat and habitat capability.

Timber rotations are normally over a 100-year or longer rotation, depending upon site quality. To ensure adequate production of timber, harvest has been scheduled to allow the earliest cut stands to mature into merchantable timber before the planned harvest of original stands is complete. When the first rotation is complete, mature timber stands would be harvested again on a new rotation. Management of the timber resource on these rotations could affect long-term productivity, depending on the intensity of silvicultural practices. Projected timber rotation lengths are not anticipated to affect long-term productivity. Mitigation measures are planned under all the alternatives to ensure future availability of other renewable resources as well.

Opportunities for dispersed recreation use, including hiking, camping, and fishing, would be maintained and increased for future generations. The setting in which these activities occur

Irreversible Commitments of Resources

varies by alternative, but the long-term potential for the Project Area to provide a spectrum of recreation opportunities would be maintained in all alternatives.

Irreversible commitments are decisions affecting nonrenewable resources such as soils, wetlands, unroaded areas, and cultural resources. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense or because the resource has been destroyed or removed.

The construction of arterial and collector roads, to provide access to the Forest, is an irreversible action because of the time it takes for a constructed road to revert to natural conditions. Irreversible actions also include the associated rock quarries which are developed in conjunction with these roads. Alternative 1 will have no new road construction, while Alternatives 2, 5, and 7 would construct roads and quarries to harvest units as described under the Transportation section of this Chapter. This will require that up to 30 acres of ground be irreversibly committed to rock quarries and up to 0.72 million cubic yards of rock fill to be placed for road construction and reconstruction.

There are three roadless areas as identified in the TLMP Final EIS (1997) that may be affected by the Sea Level project. A decision to develop these roadless areas would mean that their primitive character in terms of opportunities for solitude, remoteness, and development of wilderness skills would be foregone. Alternative 1 would have no new roads constructed or units harvested, while Alternatives 2, 5, and 7 would construct roads and harvest timber as described in the Roadless Areas section of this chapter. Implementation of an action alternative would result in an irreversible loss of portions of these roadless areas.

Old-growth habitat lost due to clearcut logging can be considered an irreversible effect since it is not expected to gain old-growth characteristics for at least 150 years. Alternative 1 would not harvest any old growth, while Alternatives 2, 5, and 7 would harvest old-growth timber as described in the Silviculture, Timber, Wildlife, and Biodiversity sections of this chapter.

Loss of soil due to erosion and mass failures are irreversible commitments of resources. However, due to the incorporation of BMPs, Forest Plan Standards and Guidelines, and mitigation measures specified in this document, it is not anticipated that there would be any significant soil loss under any alternative.

Loss of cultural resource sites resulting from accidental damage or vandalism would be an irreversible commitment of resources. The standards and guidelines, survey methodology prior to activities, and mitigation measures specified in this document provide reasonable assurance that there would be no irreversible loss of cultural resources.

Irretrievable Commitments

Irretrievable commitment of natural resources means loss of production or use of resources due to management decisions made in the alternative. This represents opportunities foregone for the period of time that the resource cannot be used.

Foregoing timber harvest opportunities at this time in certain areas due to resource concerns or economics may represent an irretrievable commitment of resources because that volume cannot be harvested. The commitment is irretrievable rather than irreversible, because future entries could harvest those areas if they are still classified as part of the suitable timber base.

The reduction in the scenic integrity of an area due to timber harvesting will be an irretrievable commitment of resources. The commitment is irretrievable since viewsheds will typically heal from a scenic standpoint after about 40 years. After this time, the second-growth trees will have the color and height needed so as not to be evident to the casual

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Possible Conflicts with Plans and Policies of Other Jurisdictions

observer. Alternative 1 will have no irretrievable commitment of visual quality. Alternatives 2, 5, and 7 will irretrievably commit visual resources due to timber harvesting activities.

The regulations for implementing NEPA require a determination of possible conflicts between the proposed action and the objectives of Federal, State, and local land-use plans, policies, and controls for the area. The major land-use regulations of concern are the Coastal Zone Management Act (CZMA), Section 810 of ANILCA, and the State of Alaska's Forest Practices Act. A discussion of each of these determinations is presented below.

Coastal Zone Management Act (CZMA) of 1976

The CZMA was passed by Congress in 1976 and amended in 1990. This law requires Federal agencies conducting activities or undertaking development affecting the coastal zone to ensure that the activities or developments are consistent with approved state coastal management programs to the maximum extent practicable. The State of Alaska passed the Alaska Coastal Management Act in 1977, to establish a program that meets the requirements of the CZMA. It contains the standards and criteria for a determination of consistency for activities within the coastal zone.

The Forest Service has evaluated the alternatives to ensure that the activities and developments affecting the coastal zone are consistent with approved coastal management programs to the maximum extent practicable. The standards and guidelines for timber management activities in the Sea Level Project Area meet or exceed those indicated in the Alaska Forest Practices Act and the Alaska Coastal Management Program (ACMP).

Evaluation of the proposed activities against standards and guidelines for activities within the coastal zone results in a finding that these activities are consistent with the ACMP to the greatest extent practicable. In accordance with the Memorandum of Understanding and Alaska statutes, the State of Alaska Office of Governmental Coordination will perform a preliminary consistency review of this EIS.

Alaska National Interest Lands Conservation Act (ANILCA) of 1980

Under Section 810 of ANILCA, agencies are required to evaluate the effects of proposed actions on subsistence uses of Federal land and determine if the proposed action may significantly restrict subsistence opportunities. Refer to the Subsistence section of this chapter for the evaluation of impacts to subsistence use as a result of the alternatives.

State of Alaska's Forest Practices Act of 1990

On May 11, 1990, the governor approved the legislature's major revision of the State's Forest Practices Act (FPA). The revised act significantly increases the State's role in providing protection and management for important forest resources on State and private lands. The revised FPA will also affect National Forest management through its relationship to the ACMP and the Federal CZMA (see above discussion).

For National Forest timber operations, such as proposed for the Sea Level project, the effect of the revised FPA is essentially two-fold. First, it clarifies that the revised FPA regulations are the standard which must be used for evaluating timber harvest activities on Federal lands for purposes of determining consistency to the maximum extent practicable with the Alaska Coastal Zone Management Program. Secondly, it calls for minimum 100-foot buffers on all anadromous and high value resident fish streams and recognizes that consistency to the maximum extent possible for purposes of the ACMP is attainable in Federal timber harvest activities using specific methodologies which may differ from those required by the revised FPA or its implementing regulations.

The Forest Service has evaluated the alternatives to ensure that the activities and developments affecting the coastal zone are consistent with approved coastal management programs to the maximum extent practicable. The layout of all proposed harvest units

**Energy
Requirements and
Conservation
Potential of
Alternatives**

comply with the TTRA requirements for stream buffers and the more stringent Forest Plan Riparian buffer requirements which exceed the stream buffer requirements in the Alaska FPA.

The Forest Service has evaluated all Project Alternatives (including the ROD) prior to completion of the Final EIS and the ROD issuance to ensure that the activities and developments specifically covered by the FPA are consistent with its provisions to the maximum extent possible.

The implementation of the proposed actions in the Project Area will require the expenditure of energy (e.g., fuel consumption). The amount of energy used varies by alternative based on timber volume harvested and miles of road constructed or reconstructed. The direct effect of the alternatives on energy requirements would be attributed to timber harvest, road construction and reconstruction, and travel necessary to prepare and administer the timber sale. Indirect energy requirements include processing wood products and the transport of the products to secondary processors and consumers. It has been determined that estimating indirect energy requirements used by secondary processors and consumers are unattainable, as well as beyond the scope of this document. They are therefore not displayed.

Fuel Consumption

Fuel consumption requirements were estimated as follows:

Timber Sale Preparation and Administration, 1.56 gallons/MBF

Cable Logging, 2 gallons/MBF

Helicopter Logging, 8 gallons/MBF

Load, Haul, Dump and Tow, 8 gallons/MBF

Road Construction, 4,000 gallons/mile

Road Maintenance, 20 gallons/mile

The estimated total fuel consumption required for each alternative is displayed in Table Other-1.

**Table Other-1
Estimated Direct Fuel Consumption by Alternative**

	Alternative			
	1	2	5	7
Thousands of gallons	0	1,091	323	698
Average gallons/MBF	0	65	62	63

Source: Babik 1998

Note: The estimated fuel consumption for timber harvest activities is based on consumption per MBF of sawlog volume.

Conservation Potential

To conserve fuel and/or minimize harvesting costs, the Forest Service has undertaken studies and allowed experimentation with new harvesting equipment and techniques. Shovel yarding is estimated to use 2.7 gallons of fuel per MBF, which is almost a gallon more per MBF than for cable yarding; however, savings are realized in labor costs. Labor cost per MBF is based

3 Environment and Effects

on a crew size of 1-2 people for shovel yarding compared to an average of four people for cable yarding.

The use of low tire pressure equipment or central tire inflation (CTI) during road construction and logging has also shown to decrease costs during studies nationwide and on the Stikine Area of the Tongass National Forest. Studies on Mitkof Island indicate that 10 to 14 percent less rock was needed during road construction, resulting in cost savings of approximately \$450,000. It is predicted that costs for rock replacement/road maintenance, log truck fuel, and tire repair and replacement will decrease. Cost savings have proven to be substantial enough that the Forest Service provides a contract clause allowing a reduction in rock replacement deposits when low tire pressure equipment is used.

The use of cable yarding equipment fitted with mechanical or hydraulic interlocking drums provides the ability to decrease yarding expense as the throttle and brake do not have to be ridden simultaneously to provide suspension for a turn of logs.

Natural or Depletable Resource Requirements and Conservation Potential

All alternatives considered in detail are designed to conform to applicable laws and regulations pertaining to natural or depletable resources, including minerals and energy resources. Regulation of mineral and energy activities on the National Forest, under the U.S. Mining Laws Act of 1872, and the Mineral Leasing Act of 1920, is shared with the Bureau of Land Management (BLM). The demand for access to National Forest system lands for the purpose of mineral and energy exploration and development is expected to increase over time.

The action alternatives propose road construction that will increase opportunities for access to the National Forest within the Project Area. This increased access may result in increased activity with regard to both known and potential mineral or energy resource occurrences. The actual potential for increased mineral or energy resource activity in the Project Area is not known, nor can an accurate estimate be made.

Urban Quality, Historic and Cultural Resources

The Project Area contains no urban areas. Therefore, the only applicable concern under this topic is with historic and cultural resources. The goal of the Forest Service's Cultural Resource Management Program is to preserve significant cultural resources in their field setting and ensure they remain available in the future for research, social/cultural purposes, recreation, and education. The direct, indirect, and cumulative effects of the alternatives on cultural resources have been evaluated. The result of this evaluation is the determination that there are adequate Standards, Guidelines, and procedures to protect cultural resources and to meet the goals of the Cultural Resource Management Program. Cultural resources are discussed further in the Cultural section of this chapter.

Consumers, Civil Rights, Minorities, and Women

All Forest Service actions have the potential to produce some form of impact, positive and/or negative, on the civil rights of individuals or groups, including minorities and women. The need to conduct an analysis of this potential impact is required by Forest Service Manual and Forest Service Handbook direction. The purpose of the impact analysis is to determine the scope, intensity, duration, and direction of impacts resulting from a proposed action. For environmental or natural resource actions, such as proposed for the Project Area, the civil rights impact analysis is an integral part of the procedures and variables associated with the social impact analysis. This analysis is discussed in the Socioeconomic section of this chapter.

The effect of the alternatives on consumers is reflected in the discussion of the various goods and services supplied as a result of the proposed actions. This analysis occurs throughout the chapter as an integral part of the analysis of the effects on other components of the environment. No negative impacts to civil rights of individuals or groups, including minorities and women are anticipated to be associated with this project. Additional information can be found in the TLMP Final EIS Chapter 3 and Appendix H.

Prime Farmland, Rangeland, and Forest Land

All alternatives are in keeping with the intent of Secretary of Agriculture Memorandum 1827 for prime land. The Project Area does not contain any prime farmlands or rangelands. Prime forest land does not apply to lands within the National Forest System. In all alternatives, lands administered by the Forest Service would be managed with a sensitivity to the effects on adjacent lands.

Environmental Justice

Executive Order 12898 directs Federal agencies to identify and address the issue of environmental justice, i.e., human health and environmental effects of agency programs that disproportionately impact minority and low income populations. The Executive Order specifically directs agencies to consider patterns of subsistence hunting and fishing when an agency action may affect fish or wildlife. The issue of environmental justice has been addressed through the Sea Level NEPA analysis by identifying low income communities that may be affected by the proposed action, by ensuring that scoping and public involvement activities reach those communities, by evaluating the effects of the proposed action on such communities, and by documenting the analysis. Detailed discussion of potential project effects on communities and subsistence is presented in the Subsistence Resource Report.

The communities of Saxman and Metlakatla fall within intent the Executive Order. The project will affect subsistence resources, though not to the point where these communities' use of subsistence resources would be restricted. Providing timber to meet demand will benefit these communities whose residents are employed in the timber industry, even if not purchased directly by the industries in Metlakatla or Saxman.

Essential Fish Habitat

The potential effects of the project on essential fish habitat have been evaluated.

Estimates of sediment delivery to Southeast Alaska streams from timber harvest indicate that sediment increases are minimal and not distinguishable from natural fluctuations in sediment yield. Some increases in sediment delivery to streams above naturally occurring rates can be expected to result from timber harvest and road construction (Rice et al. 1979; Madej 1982; Reid and Dunn 1984; Furniss et al. 1991; Chamberlin et al. 1991).

Road construction and timber harvest increase the risk of landslides. Of the action alternatives, Alternative 5 proposes building the least amount of road over high MMI=3 sites, and Alternative 2 proposes to build the most over these landtypes. There is a low potential for measurable impacts to water quality and fish habitat from management-induced landslides if any of the action alternatives are implemented. The results of a Tongass-wide landslide survey can help illustrate the potential for landslide impacts in the Sea Level Project Area (Swanston and Marion 1991). This regional landslide survey, which included only large landslides greater than 100 cubic yards of soil displacement, estimates a landslide rate of 1.7 slides over a 20-year period. However, these results also indicate that a relatively small percentage of sediment generated from large landslide events will reach a stream. Swanston (1989) estimated that the increase in the incidence of landslides over natural occurrences throughout Southeast Alaska was about 3.5 times greater on managed acres.

Swanston's Tongass landslide survey categorized 23 percent of all landslides as debris torrents that occur in deeply cut V-notch gullies. Long-term impacts (greater than 10 years) to channel form and function and to fish habitat would be anticipated for Class I channel segments directly affected by a large landslide (Hogan and Wilford 1989). Based on Swanston's results, there is about a one-in-four chance that any management-related landslide will have an impact on Class I streams and only a very slight chance that impacts on fish habitat could occur. It can be inferred that the majority of these landslides would affect primarily Class III stream channels, as only three percent of all natural and management-induced slide events in this survey were shown to directly affect Class I streams.

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Approximately one debris slide, 5 acres or larger, occurs for every 2,240 of harvested acres Forest wide (TLMP 1997). If slides smaller than 5 acres are included, then the number of debris slides occurring for every 2,240 harvested acres would increase 150 percent. The average size of a slide on the Ketchikan Area is 5 acres (Loggy 1974).

Care should be taken in extrapolating these results to the Project Area. Road construction and harvesting technology changes, as well as greater sensitivity to water quality and fish habitat concerns (as reflected in BMPs, for example, and much improved soil and water inventory information), have resulted in more effective management practices for timber operations in landslide prone areas. These factors will tend to reduce management-related landslide incidences in the Project Area from the rate observed by Swanston. On the other hand, many of the areas included in Swanston's survey had road systems that were predominantly located on stable locations on lower valley slopes. Roaded segments in the Project Area are proposed on relatively steep slopes, a factor which would tend to increase the potential incidence of road-related landslides. Thus, the frequency of landslide occurrence in the area is difficult to predict; however, areas with a high potential for landslide occurrence were evaluated in the planning process, and timber harvest was deferred in many of these areas during unit design.

For the Sea Level Project, TLMP standards and guidelines for process group riparian buffers have been applied in all instances on Class III streams. One stream, a Class III alluvial fan, provided an opportunity to modify process group standards and guides (Unit 133). Site-level watershed analysis was conducted and a partial-cut riparian buffer was implemented, resulting in the harvest of 26 trees.

Of the ten major watersheds in the Project Area, no alternative proposes harvest in the Fish Creek or Licking Creek watersheds. Alternatives 5 and 7 propose no harvest in the Spit Creek watershed, and Alternative 5 proposes no harvest in the Sea Level Creek or Marble Creek watersheds.

In evaluating the potential effects on essential fish habitat, the following factors were considered

- the historical success of BMP implementation on the Ketchikan Area,
- the avoidance of timber harvest and road construction in two of the more important watersheds (in all alternatives) and another in the preferred alternative (Alternative 7), and
- the exclusion of harvest on slopes greater than 72 percent unless field review of professional soil scientists indicated harvest of these slopes can be accomplished with no damage to other resources.

Based on the above factors, the risk of measurable impact on essential fish habitat is minimal in the Sea Level Project Area.

Chapter 4

Lists

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Glossary

Access

The opportunity to approach, enter, and make use of public lands.

Access Management

Acquiring rights, developing, and maintaining facilities needed by people to, and move through public lands.

Active Channel

Unstable portion of a stream where stream channels are frequently changing course.

Adfluvial Fish

Species of populations of fish that do not go to sea, but live in lakes, and enter streams to spawn.

Aelvin

Young salmon that are still attached to the yolk sac which provides nourishment.

Aerial-Harvest Systems

Harvesting methods in which the cut logs are moved from the stump to the loading area or log deck without touching the ground (e.g. helicopter logging).

Aggradation

The process of building up a land surface by deposition (as with road maintenance).

Aquatic Habitat Management Unit (AHMU)

A mapping unit that displays an identified value for aquatic resources. It is a mechanism for carrying out aquatic resource management policy.

Class I

Streams with anadromous or high-quality sport-fish habitat. Also included is the habitat upstream from migration barriers known to have reasonable enhancement opportunities for anadromous fish.

Class II

Streams with resident-fish populations and generally steep (6 to 15 percent) gradient (can also include streams from 0 to 6 percent gradient where no anadromous fish occur). These populations have limited sport fisheries values and are separate from the high-quality sport-fishing systems included in Class I. They generally occur upstream of migration barriers or are steep-gradient streams with other habitat features that preclude anadromous fish use.

Class III

Streams with no fish populations but have potential water-quality influence on the downstream aquatic habitat.

Alaska National Interest Lands Conservation Act (ANILCA)

Passed by Congress in 1980, this legislation designated 14 National Forest Wilderness Areas in Southeast Alaska. The Alaska National Interest Lands Conservation Act of December 2, 1980, Public Law 96-487, 96th Congress, 94 Stat. 2371-2551, Section 810 requires evaluations of subsistence impacts before changing the use of these lands.

Alaska Native Claims Settlement Act (ANCSA)

Public Law 92-203, 92nd Congress, 85 Stat. 2371-2551. Approved December 18, 1971, ANCSA provides for the settlement of certain land claims of Alaska natives and for other purposes.

Allowable Sale Quantity (ASQ)

The ASQ refers to the maximum quantity of timber that may be sold each decade from the Tongass National Forest. This quantity, expressed as a board foot measure, is calculated per timber utilization standards specified in the Alaska Regional Guide, the number and type of acres available for timber management, and the intensity of timber management. The ASQ was calculated at 2.67 billion board feet per decade for the Tongass National Forest (TLMP 1997).

Alluvial Fan

A cone-shaped deposit of organic and mineral material made by a stream where it runs out onto a level plain or meets a slower stream.

Alluvium

Material deposited by rivers or streams, including the sediment laid down in river beds, flood plains, and at the foot of mountain slopes and estuaries.

Alpine

The part of a mountain above tree growth.

Alternative

One of several options proposed for decision making.

Anadromous Fish

Fish (such as salmon, steelhead, and sea-run cutthroat trout) that spend part of their lives in freshwater and part in saltwater.

Anadromous Species

One whose individuals are born in freshwater but migrate to and feed in the sea before returning to freshwater to breed.

Background

The distant part of a landscape. The area viewed from 3 or 5 miles to infinity, from the viewer (see *Foreground* and *Middleground* for comparison).

Beach-Fringe Use Area

Nonforested wildlife-use areas which occur from the intertidal zone inland 500 feet, and islands of less than 50 acres. Forested wildlife-use areas that occur from the intertidal zone inland 600 feet, and islands of less than 50 acres.

Bedload

Sand, silt, and rock debris rolled along the bottom of a stream by the moving water.

Benthic

Refers to the substrate and organisms, in and on the bottom of a body of water.

Best Management Practice (BMP)

Practices used for the protection of water quality. BMPs are designed to prevent or reduce the amount of pollution from nonpoint sources or other adverse water-quality impacts, while meeting other goals and objectives. BMPs are standards to be achieved, not detailed or site-specific prescriptions or solutions.

Biological Diversity (Biodiversity)

The variety of life in all its forms and at all levels. This includes the various kinds and combinations of: genes, species of plants, animals and microorganisms, populations, communities, and ecosystems. It also includes the physical and ecological processes that allow all levels to interact and survive. The most familiar level of biological diversity is the species level, which is the number and abundance of plants, animals, and microorganisms.

Blowdown

See windthrow.

Board Foot (BF)

A unit of wood 12" by 12" by 1". One acre of commercial timber in Southeast Alaska, on the average, yields 28,000 to 34,000 (ranging from 8,000 to 90,000) board feet per acre. One million board feet (MMBF) yields approximately enough timber to build 120 houses.

Braided Streams or Channels

A stream flowing in several dividing and reuniting channels resembling the strands of a braid; the cause of division being obstruction by sediment, deposited by the stream.

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Cant

A log partly or wholly cut and destined for further processing.

Channel Migration

Movement of a stream or river channel within its floodplain area, usually over an extended period of time.

Clearcut

Harvesting method in which all trees are felled in one cut. It prepares the area for a new, even-aged stand. The area harvested may be a patch, strip, or stand large enough to be mapped or recorded as a separate age class.

Climax Community

A community of plants and animals which is relatively stable over time and which represents the late stages of succession under current climate and soil conditions.

Commercial Forest Land (CFL)

Forest Land that is producing or capable of producing crops of industrial wood and (a) has not been withdrawn by Congress, the Secretary, or the Chief; (b) existing technology and knowledge is available to ensure timber production without irreversible damage to soil productivity, or watershed conditions; and (c) existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that adequate restocking can be attained within 5 years after final harvesting.

Normal

Timber that can be economically harvested with locally available logging systems. Composed of two categories:

Standard

Timber that can be economically harvested with locally available logging systems, such as highlead or short-span skyline.

Special

Timber that is in areas where special consideration is needed to protect other resources but can be harvested with locally available logging systems.

Nonstandard

Timber that cannot be harvested with locally available logging systems and would require the use of other logging systems such as helicopter or long-span skyline.

Commercial Thinning

Thinning a stand where the trees to be removed, are large enough to sell.

Confluence

The point where two streams meet.

Connectivity

A measure of the extent that the forest areas, between or outside reserves, provide habitat for breeding, feeding, dispersal and movement of wildlife.

Corridor

Connective links of certain types of vegetation between patches of suitable habitat which are necessary for certain species to facilitate movement of individuals between patches of suitable habitat. Also may refer to transportation or utility right-of-way.

Cover

Refers to trees, shrubs, or other landscape features that allow an animal to partly or fully conceal itself.

Critical Habitat

Specific terrain within the geographical area occupied by threatened or endangered species. Physical and biological features that are essential to conservation of the species and which may require special management considerations or protection, are found in these areas.

Crown

The upper part of a tree or woody plant that carries the main branch system and foliage.

Cruise

Refers to the activity of determining timber volume and quality.

Cull Logs

Trees that do not meet certain quality specifications.

Culmination Mean Annual Increment (CMAI)

The point at which a tree (or stand) achieves its highest average growth, based on expected growth according to the management intensity and utilization standards assumed in the TLMP.

Cultural Resources

Historic or prehistoric objects, sites, buildings, structures, and their remains, resulting from past human activities.

Cutover

Areas recently harvested.

Diameter Breast Height (DBH)

The diameter of a tree measured 4 feet 6 inches from the root collar on the uphill side of the tree.

Debris Avalanche

The sudden movement downslope of the soil mantle; it occurs on steep slopes and is caused by the complete saturation of the soil from prolonged heavy rains. Also known as a debris slide.

Debris Flow

A general term for all types of rapid movement of debris downslope.

Debris Torrents

Avalanche materials which either dam a channel temporarily or accumulate behind temporary obstructions such as logs and forest debris, result in a landslide when the dam breaks. Debris torrents are usually confined within the stream channel until they reach the valley floor where the debris spreads out, inundating vegetation and forming a broad surface deposit.

Deer Winter Range

Locations that provide food and shelter for Sitka black-tail deer under moderately severe to severe winter conditions.

Degradation

The general lowering of the surface of the land by erosive processes, especially by the removal of material through erosion and transportation by flowing water.

Detritis

Material, produced by the disintegration and weathering of rocks, that has been moved from its site of origin.

Developed Recreation

Recreation that requires facilities which in turn, result in concentrated use of an area. Facilities in these areas might include roads, parking lots, picnic tables, toilets, water fountains, and buildings.

Direct Employment

The jobs that are immediately associated with timber harvest and processing, including, for example, logging, sawmills, and pulpmills.

Discount Rate

The rate used to adjust future benefits or costs to their present value.

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Dispersion

To disperse the effects of timber harvest by distributing harvest units more or less uniformly throughout a drainage so that increased runoff and sediment from disturbed sites will be buffered by lower levels of runoff and sediment production from surrounding undisturbed lands.

Dissected Landforms

A physical, recognizable form or feature of the earth's surface such as a mountain, hill, or valley having a characteristic shape, that in part is the result of several shallow or deeply incised drainage channels.

Dissolved Oxygen

The amount of free (not chemically combined) oxygen in water.

Distance Zone

Areas of landscapes denoted by specified distances from the observer (foreground, middleground, or background). Used as a frame of reference in which to discuss landscape characteristics of management activities.

Diversity

The distribution and abundance of different plant and animal communities and species within an area.

Draft Environmental Impact Statement (Draft EIS)

A statement of environmental effects for a major Federal action, which is released to the public and other agencies for comment and review prior to a final management decision. Required by Section 102 of the National Environmental Policy Act (NEPA).

Eagle-Nest-Tree Buffer Zone

A 330-foot radius around eagle-nest trees established in an Interagency Memorandum of Understanding between the US Fish and Wildlife Service and the Forest Service.

Ecosystem

A community of organisms and its physical setting. An ecosystem, whether a fallen log or an entire watershed, includes resident organisms, nonliving components such as soil nutrients, inputs such as rainfall, and outputs such as organisms that disperse to other ecosystems.

Ecotone

A transition or junction zone between two or more ecosystems.

Ecotype

A species of plant or animal that displays different genetic or physiological adaptations. For example, the brown bear in Southeast Alaska is the same species as the grizzly bear in interior Alaska, but the brown bear is generally larger than the grizzly.

Effects

Effects, impacts, and consequences as used in this environmental impact statement are synonymous. Effects may be ecological (such as the effects on natural resources) aesthetic, historical, cultural, or socioeconomic, and may be direct, indirect, or cumulative.

Direct Effects

Results of an action occurring when and where the action takes place.

Indirect Effects

Results of an action occurring at a location other than where the action takes place and/or later in time, but in the reasonably foreseeable future.

Cumulative Effects

The impact on the environment resulting from incremental impacts of past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or nonfederal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions occurring over time.

Encumbrance

A claim, lien, charge, or liability attached to and binding real property.

Endangered Species

Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act. See also, threatened species, sensitive species.

Erosion

The wearing away of the land surface by running water, wind, ice, gravity, or other geological activities.

Escapement

Adult anadromous fish that escape from all causes of mortality to return to streams to spawn.

Estuarine Buffer

A 1,000-foot wide zone around an estuary.

Estuary

Refers to the relatively flat, intertidal, and upland areas generally found at the heads of bays and mouths of streams. They are predominately mud and grass flats and are unforested except for scattered spruce or cottonwood.

Even-Aged Management

The application of a combination of actions which result in the creation of stands where trees are essentially the same age. The difference in age between trees in the main canopy level usually does not exceed 20 percent of the age of the stand at harvest rotation age. Clearcut, shelterwood, or seed-tree cutting methods produce even-aged stands.

Executive Order

An order or regulation issued by the President or some administrative authority under his or her direction.

Existing Visual Condition

The visual quality presently occurring on the ground. The six existing visual condition categories are:

Type I: Natural Condition

Areas in which only ecological change has taken place. Corresponds to the Preservation Visual Quality Objectives (VQO).

Type II: Natural Appearing

Areas in which changes in the landscape are not noticed by the average forest visitor unless pointed out. Corresponds to the Retention VQO.

Type III: Slightly Altered

Areas in which changes in the landscape are noticed, but do not attract attention. Corresponds to the Partial Retention VQO.

Type IV: Moderately Altered

Areas in which changes in the landscape are easily noticed and may attract attention. Corresponds to the Modification VQO.

Type V: Heavily Altered

Areas in which changes in the landscape obviously appear to be major disturbances and stand out as a dominating impression of the landscape. Corresponds to the Maximum Modification VQO.

Type VI: Drastically Altered

Areas in which changes in the landscape are in glaring contrast to a natural appearance. Not a VQO.

Final Environmental Impact Statement (Final EIS)

The final version of the statement of environmental effects required for major Federal actions under Section 102 of the National Environmental Policy Act. It is a revision of the draft environmental impact statement (EIS) to include public and agency responses to the draft. The decision maker chooses which alternative to select from the Final EIS, and subsequently issues a Record of Decision (ROD).

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Fiscal Year (FY)

October 1 through September 30. For example October 1, 1997 through September 30, 1998 equals FY98.

Floodplain

That portion of a river valley, adjacent to the river channel, which is covered with water when the river overflows its banks at flood stages.

Fluvial

Of or pertaining to streams and rivers.

Foreground

The stand of trees immediately adjacent to a scenic area, recreation facility, or forest highway; area located less than 1/4 mile from the viewer (see Background and Middleground for comparison).

Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA)

Amended in 1976 by the National Forest Management Act.

Forest Land

National Forest System lands currently supporting or capable of supporting forests at a density of 10 percent crown closure or more. Includes all areas with forest cover, including old growth and second growth, and both commercial and noncommercial forest land.

Forested Wetland

A wetland whose vegetation is characterized by an overstory of trees that are 20 feet or taller.

FORPLAN

A forest planning model. A linear programming software package used to analyze planning decisions regarding land-use patterns, capital investment, and timber-harvest scheduling.

FSH

Forest Service Handbook.

FSM

Forest Service Manual.

Geographic Information System (GIS)

An information processing technology to input, store, manipulate, analyze, and display spatial and attribute data to support the decision-making process. It is a system of computer maps with corresponding site specific information that can be electronically combined to provide reports and maps.

Geomorphology

The study of the forms of the land surface and the processes producing them. Also the study of the underlying rocks or parent materials formed in geological time.

Glide or Placid Streams

Grouping of channel types (L1 and L2) that have fairly consistent physical characteristics occurring on lowland landforms and are mostly associated with bogs, marshes, or lakes.

Groundwater

Water within the earth that supplies wells and springs.

Guideline

A preferred or advisable course of action or level of attainment designed to promote achievement of goals and objectives.

Habitat

The sum total of environmental conditions of a specific place occupied by an organism, population, or community of plants and animals.

Habitat Capability

The number of healthy animals that a habitat can sustain. Used in wildlife models to calculate rough population estimates for Management Indicator Species.

Habitat Improvement

Management of wildlife and fish habitat to increase its capability.

Hard Snags/Soft Snags

Hard snags are dead trees which have hard wood and little decay. Soft snags are dead trees which have soft, broken wood and considerable amount of decay.

Haul Out

An area of large, smooth rocks used by seals and sea lions for resting and pupping.

Humus

Soil component of organic origin that is fairly resistant to bacterial decay.

Hydrophyte

Plants typically found in wet habitats.

IMPLAN

Impact analysis for PLANning. A computer-based system used by the Forest Service for measuring economic input. The system includes a data base for all counties in the United States and a set of computer programs to retrieve data and perform the computational tasks.

Indirect Employment

The jobs in service industries that are associated with timber harvest including, for example, suppliers of logging and milling equipment.

Inoperable Timber

Timber that cannot be harvested by any proven method because of potential resource damage, extremely adverse economic considerations, or physical limitations.

Interdisciplinary Team (IDT)

A group of people with different backgrounds assembled to research, analyze, and write a project environmental impact statement.

Invertebrates

Animals without a backbone.

Irretrievable Commitments

Losses of production or use of renewable natural resources for a period of time. For example, timber production from an area is irretrievably lost during the time an area is allocated to a no-harvest prescription; if the allocation is changed to allow timber harvest, timber production can be resumed. The production lost is irretrievable, but the action is not irreversible.

Irreversible Commitments

Decisions causing changes which cannot be reversed. For example, if a tree is cut, that action cannot be reversed. The tree cannot be "uncut". This term often applies to the extraction of nonrenewable resources such as minerals.

Issue

A point, matter, or section of public discussion or interest to be addressed or decided.

Knutson-Vandenburg Fund (KV)

The portion of timber sale receipts collected and used for reforestation and other renewable resource projects on the sale area.

4 Lists

Land-Use Designation (LUD)

The method of classifying land uses presented in the Tongass Land Management Plan (TLMP). Land uses and activities are grouped to define a compatible combination of management activities. Implementation of the TLMP would achieve desired future conditions, goals, and objectives for 19 Land-Use Designations.

Landslides

The moderately rapid to rapid down-slope movement of soil and rock materials that may or may not be water-saturated.

Large Woody Debris (LWD)

Any large piece of relatively stable woody material having a diameter of at least 4 inches and a length greater than 3 feet that intrudes into the stream channel. Also called Large Organic Debris (LOD).

Legacy Tree

Trees, pole-sized or larger, retained in either a dispersed or aggregated manner after harvest.

Log-Transfer Facility (LTF)

A facility that is used for transferring commercially harvested logs to and from a vessel or log raft, or a log raft. It is wholly or partially constructed in waters of the United States and location and construction are regulated by the 1987 Amendments to the Clean Water Act.

Logging Systems

Aerial

Systems where the cut logs are moved from the stump to the loading area or log deck without touching the ground.

Helicopter

Flight path cannot exceed 40 percent downhill or 30 percent uphill; landings must be selected so there is adequate room for the operation and so that the helicopter can make an upwind approach to the drop zone.

A-Frame

A water float-mounted yarder, typically rigged in a highlead configuration, to harvest timber from the beach fringe.

Cold-Deck and Swing

Planned to access areas not suitable for skyline operations.

Highlead

A cable yarding system, using a two-drum yarder, in which lead blocks are hung on a spar or tower to provide lift to the front end of the logs. Grabinski is a modified highlead cable system.

Live-Skyline/Gravity Carriage Return

A two-drum, live-skyline yarding system in which the carriage moves down the skyline by gravity thus, is restricted to uphill yarding; the skyline is lowered to attach logs then raised and pulled to the landing by the mainline.

Live-Skyline/Haulback Required

A live-skyline yarding system composed of skyline, mainline, and haulback. The carriage is pulled to the woods by the haulback. The skyline is lowered to permit the chokers to be attached to the carriage, and the turn is brought to the landing by the mainline.

Multispan Skyline

European equipment is commonly associated with this.

Running Skyline

A yarding system with three suspended moving lines, generally referred to as the main, haulback, and slack-pulling, that when properly tensioned will provide lift, travel, and control to the carriage. Normally indicates a gantry type tower and a three-drum yarder.

Shovel

A system of short-distance logging in which logs are moved from the stump to the landing by repeated swinging with a swing-boom log loader. The loader is walked off the haul road and out into the harvest unit; logs are moved and decked progressively closer to the haul road with each pass of the loader. When logs are finally decked at roadside, the same loader, or a different loader, loads the logs onto trucks. On gentle ground, logs are either heeled and swung or dragged by the boom as it rotates; larger log length and tree-length logs are usually dragged to maintain machine stability. Soils should be moderate to well drained and side slopes must be less than 20 percent; passes, or strips, should be kept to a maximum of 4.

Standing Skyline

Used wherever yarding distances or span distances exceed the capability of live-skyline equipment.

Tractor

Used to describe the full range of surface skidding equipment, designed to operate on level to downhill settings.

MBF

Thousand board feet net sawlog and utility volume.

MMBF

Million board feet net sawlog and utility volume.

MMCF

Million cubic feet net sawlog and utility volume.

Management Indicator Species (MIS)

Species selected in a planning process that are used to project the effects of planned management activities on wildlife and fish that are socially or economically important.

Management Prescription

The intensity and schedule of management practices in a Land-Use Designation to attain multiple-use and other goals and objectives.

Management Requirement

Standards for resource protection, vegetation manipulation, silvicultural practices, even-aged management, riparian areas, soil and water and diversity, to be met in accomplishing National Forest System goals and objectives. (see 36 CFR 219.17)

Mass Failure

The downslope movement of a block or mass of soil. This usually occurs under conditions of high-soil moisture and does not include individual soil particles displaced as surface erosion.

Mean Annual Increment (MAI)

The total volume of a stand divided by its age.

Memorandum of Understanding (MOU)

A legal agreement between the Forest Service and others agencies resulting from consultation between agencies that states specific measures the agencies will follow to accomplish a large or complex project.

Microclimate

The temperature, moisture, wind, pressure, and evaporation of a very small area that differs from the general climate of the larger surrounding area.

Middleground

The visible terrain beyond the foreground where individual trees are still visible but do not stand out distinctly in the landscape; area located from ¼ to 5 miles from the viewer (see Foreground and Background for comparison).

Mineral Soils

Soils consisting predominately of mineral material.

Mining Claims

A geographic area of the public lands held under the general mining laws in which the right of exclusive possession is vested in the locator of a valuable mineral deposit.

Mitigation

Measures designed to minimize environmental impacts or to make impacts less severe.

4 Lists

Mixed Conifer

In Southeast Alaska, mixed conifer stands usually consist of western hemlock, mountain hemlock, Alaska yellowcedar, Western redcedar, and Sitka spruce species. Shorepine may occasionally be present depending on individual sites.

Model

A representation of reality used to describe, analyze, or understand a particular concept. A model may be a relatively simple qualitative description of a system or organization, or a highly abstract set of mathematical equations. A model has limits to its effectiveness, and is used as one of several tools to analyze a problem.

Monitoring

A process of collecting information and observing results of management activities, to provide a basis for the periodic evaluation of the project and its effects.

Multiple-Aged Stands

An intermediate form of stand structure between even and uneven-aged stands. These stands generally have two or three distinct tree canopy levels occurring within a single stand.

Multiple Use

The management of all the various renewable resources of the National Forest System, to be used in the combination that will best meet the needs of the American people.

Muskeg

In Southeast Alaska a type of bog that has developed over thousands of years in depressions or flat areas on gentle to steep slopes. Also called peatlands.

National Environmental Policy Act (NEPA) of 1969

An Act to declare a National policy which will: (1) encourage productive and enjoyable harmony between humankind and the environment, (2) promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, (3) enrich the understanding of the ecological systems and natural resources important to the Nation, and (4) establish a Council on Environmental Quality.

National Forest Management Act (NFMA)

A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of plans for National Forests.

National Wild and Scenic River System

Rivers with outstanding scenic, recreational, geological, fish and wildlife, historic, cultural, or other similar values designated by Congress under the Wild and Scenic Rivers Act for preservation of their free-flowing condition.

Native Allotment

A tract of nonmineral land, not to exceed 160 acres, on which an Alaska Native (who was 21 year of age or head of a household) established continuous use and occupancy prior to the creation of the National Forests (authorized under the Native Allotment Act of May 17, 1906).

Native Selection

Application by Native corporations and individuals to the USDI Bureau of Land Management for conveyance of lands withdrawn in fulfillment of Native entitlements established under ANSCA.

Net Sawlog Volume

Tree or log volume suitable in size and quality to be processed into lumber.

No-Action Alternative

The most likely condition expected to exist in the future if current management direction were to continue unchanged.

Noncommercial Forest Land

Land with more than 10 percent cover of commercial tree species but not qualifying as Commercial Forest land.

Nonforest Land

Land that has never supported forests and lands formerly forested but now developed for such nonforest uses as crops, improved pasture, etc.

Nonpoint Pollution

Refers to broad, diffuse activities that generate waste and pollutants which are applied, spilled, leaked, leached, eroded, or dumped onto or into land or water (Department of Environmental Conservation, State of Alaska, 1990).

Notice of Intent (NOI)

A notice printed in the Federal Register announcing that an environmental impact statement will be prepared. The NOI must describe the proposed action and possible alternatives, describe the agency's proposed scoping process, and provide a contact person for further information.

Objectives

The precise steps to be taken to achieve goals.

Old Growth

Ecosystems distinguished by old trees and related structural attributes. Old-growth forests are characterized by larger tree size, higher accumulations of large dead woody material, multiple canopy layers, different species composition, and different ecosystem function. The structure and function of an old-growth ecosystem will be influenced by its stand size and landscape position and context.

Organic Soils

Soils that contain a high percentage (generally greater than 20 to 30 percent) of organic matter throughout the soil depth.

Parent Material

The unconsolidated and partially weathered material (or the C Horizon) from which upper layers of soil developed.

Partial Cut

Method of harvesting trees where any number of live stems are left standing in any of various spatial patterns. Not clearcutting. Can include seed tree, shelterwood, or other methods.

Patch

A nonlinear surface area differing in appearance from its surroundings.

Payments to States

A fund consisting of approximately 25 percent of the gross annual timber receipts received by the National Forests in that State. This is returned to the State for use on roads and schools.

Peak flow

The highest discharge of water recorded over a specified period of time at a given stream location. Often thought of in terms of spring snowmelt, summer, fall, or winter rainy season flows. Also called maximum flow.

pH

The degree of soil acidity or alkalinity.

Planning Area

The area of the National Forest System covered by a decision document.

Planning Record

A system that records decisions and activities that result from the process of developing a Forest management project.

Plant Association

Climax plant community type.

Plant Community

Group of plants living in the same environment.

4 Lists

Population Viability

Ability of a population to survive.

Potential Yield

The maximum, perpetual, sustained-yield harvest attainable through intensive forestry on regulated areas, considering the productivity of the land, conventional logging technology, standard cultural treatments, and interrelationships with other resource uses and the environment.

Present Net Value (PNV)

The difference between the benefits and costs associated with the alternatives.

Primary Succession

Vegetation development is initiated on newly formed soils or upon surfaces exposed for the first time (as by landslides) which have, as consequence, never borne vegetation before.

Process Group

A combination of similar stream channel types based on landform, gradient, and channel shapes.

Public Participation

Meetings, conferences, seminars, workshops, tours, written comments, responses to survey questionnaires, and similar activities designed and held to obtain comments from the public about Forest Service activities.

Receipts

Money which will actually be paid to the Forest Service for benefits such as: recreation, timber harvest, mineral leases, and special use.

Record of Decision

A document separate from but associated with an Environmental Impact Statement which states the decision, identifies all alternatives, and states which practicable means have been adopted to avoid environmental harm.

Recreation Opportunity Spectrum (ROS)

A system for planning and managing recreation resources that categorizes recreation opportunities into seven classes. Each class is defined in terms of the degree to which it satisfies certain recreation needs, based on how the natural environment has been modified, the type of facilities provided, the degree of outdoor skills needed to enjoy the area and the relative density of recreation use. The seven classes are:

Primitive

An unmodified environment generally greater than 5,000 acres in size and located generally at least 3 miles from all roads and other motorized travel routes. A very low interaction between users (generally less than 3 group encounters per day) results in a very high probability of experiencing solitude, freedom, closeness to nature, tranquillity, self-reliance, challenge, and risk. Evidence of other users is low. Restrictions and controls are not evident after entering the land unit. Motorized use is rare.

Semi-Primitive Nonmotorized

A natural or natural-appearing environment generally greater than 2,500 acres in size and generally located at least ½ mile (greater or less depending on terrain and vegetation, but no less than ¼ mile) but not further than 3 miles from all roads and other motorized travel routes. Concentration of users is low (generally less than ten group encounters per day), but there is often evidence of other users. There is a high probability of experiencing solitude, freedom, closeness of nature, tranquillity, self-reliance, challenge, and risk. There is a minimum of subtle on-site controls. No roads are present in the area.

Semi-Primitive Motorized

A natural or natural-appearing environment generally greater than 2,500 acres in size and generally located within ½ mile of primitive roads and other motorized travel routes used by motor vehicles; but not closer than ½ mile (greater or less depending on terrain and vegetation, but no less than ¼ mile) from better-than-primitive roads and other motor travel routes. Concentration of users is low (generally less than ten group encounters per day), but there is often evidence of other users. There is a moderate probability of experiencing solitude, closeness to nature, and tranquillity along with a high degree of self-reliance, challenge, and risk in using motorized equipment. Local roads may be present, or along saltwater shorelines there may be extensive boat traffic.

Roaded Natural

Resource modification and utilization are evident, in a predominantly naturally-appearing environment generally occurring within ½ mile (greater or less depending on terrain and vegetation, but no less than ¼ mile) from better-than-primitive roads and other motorized travel routes. Interactions between users may be moderate to high (generally less than 20 group encounters per day), with evidence of other users prevalent. There is an opportunity to affiliate with other users in developed sites but with some chance for privacy. Self-reliance on outdoor skills is only of moderate importance with little opportunity for challenge and risk. Motorized use is allowed.

Roaded Modified

Vegetative and landform alterations typically dominate the landscape. There is little on-site control of users except for gated roads. There is moderate evidence of other users on roads (generally less than 20 group encounters per day), and little evidence of others or interactions at campsites. There is opportunity to get away from others but with easy access. Some self-reliance is required in building campsites and use of motorized equipment. A feeling of independence and freedom exists with little challenge and risk. Recreation users will likely encounter timber management activities.

Rural

The natural environment is substantially modified by land-use activities. Opportunity to observe and affiliate with other users is important as is convenience of facilities. There is little opportunity for challenge and risk and self-reliance on outdoor skills is of little importance. Recreation facilities designed for group use are compatible. Users may have more than 20 group encounters per day.

Urban

Urbanized environment with dominant structures, traffic lights and paved streets. May have natural appearing backdrop. Recreation places may be city parks and large resorts. Opportunity to observe and affiliate with other users is very important as is convenience of facilities and recreation opportunities. Interaction between large numbers of users is high. Outdoor skills, risk, and challenge are unimportant except for competitive sports. Intensive on-site controls are numerous.

Recreation Places

Identified geographical areas having one or more physical characteristics that are particularly attractive to people engaging in recreation activities. They may be beaches, streamside or roadside areas, trail corridors, hunting areas of the immediate area surrounding a lake, cabin site, or campground.

Reforestation

The natural or artificial restocking of an area with trees.

Regeneration

The process of establishing a new crop of trees on previously harvested land.

Regional Forester

The Forest Service official responsible for administering a single region.

Regional Guide

The guide developed to meet the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974 as amended. It guides natural resource management activities and establishes management standards and guidelines for the National Forest System lands within a given region.

Rehabilitation

Actions taken to protect or enhance site productivity, water quality, or other values for a short period of time.

Resident Fish

Fish that are not anadromous and that reside in freshwater on a permanent basis (e.g. nonanadromous Dolly Varden char and cutthroat trout).

Resource Values

The tangible and intangible worth of forest resources.

4 Lists

Responsible Official

The Forest Service line officer who has the authority to make a specific decision.

Restoration

The long-term placement of land back into its natural condition or state of productivity.

Revegetation

The re-establishment and development of a plant cover. This may take place naturally through the reproductive processes of the existing flora or artificially through planting or reseeding.

Roads

Arterial

Roads usually developed and operated for long-term land and resource management purposes to constant service.

Collector

Collects traffic from Forest local roads; usually connects to a Forest arterial or public highway.

Local

Provides access for a specific resource-use activity such as a timber sale or recreational site, although other minor uses may be served.

Preplanned

Roads planned in a prior EIS.

Temporary

For National Forest timber sales, temporary roads are constructed to harvest timber on a one-time basis. These logging roads are not considered part of the permanent Forest transportation network. The road is closed to vehicular traffic after harvest is completed (stream crossing structures removed, erosion measures put into place).

Roadless Area

An area of undeveloped public land within which there are no improved roads maintained for travel by means of motorized vehicles intended for highway use.

Rotation

The planned number of years between the time that a stand of trees is regenerated and its next cutting at a specified stage of maturity.

Rotation Age

The age of a stand when harvested at the end of a rotation.

Salvage Sale

A timber sale to use dead and down timber and scattered poor-risk trees that would not be marketable if left in the stand until the next scheduled harvest.

Sawlog

That portion of a tree that is suitable in size and quality for the production of dimension lumber; collectively known as sawtimber.

Scheduled Lands

Land suitable and scheduled for timber production, which is in the land base for the calculation of the allowable sale quantity and long-term sustained-yield timber capacity.

Scheduled Timber Harvests

Timber harvests planned with relation to the allowable sale quality.

Scoping Process

Early investigation to determine: the scope and significance of a proposed action, what level of analysis is required, what data is needed, and what level of public participation is appropriate. Scoping focuses on the issues surrounding the proposed action, and the range of actions, alternatives, and impacts to considered in an EA or an EIS.

Scrub-Shrub Wetland

Wetlands dominated by woody vegetation less than 20 feet tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. In Southeast Alaska this includes forested lands where trees are stunted because of poor soil drainage.

Second Growth

Forest growth that has become established following some disturbance such as cutting, serious fire, or insect attack; even-aged stands that will grow back on a site after removal of the previous timber stand.

Secondary Stream Production

Biomass resulting from the consumption by animals of materials produced in primary production in streams; this includes production of macroinvertebrates and some fish species.

Secondary Succession

The process of re-establishing vegetation after normal succession is disrupted by fire, cultivation, lumbering, windthrow, or any similar disturbance. Follows primary succession.

Sediment

Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface.

Seed Tree

Small number of seed-bearing trees, left singly or in small groups after timber harvest to provide seed for regeneration of the site.

Selective Cutting

The annual or periodic removal of trees (particularly the mature), individually or in small groups, from an uneven-aged forest to: (1) achieve balance among diameter classes needed for sustained yield, (2) to realize the yield, and (3) establish a new crop of irregular constitution. The improvement of the forest is a primary consideration.

Sensitive Species

Plant and animal species which are susceptible or vulnerable to habitat alterations or other impact from human activities. Those species that have appeared in the Federal Register as proposed for classification or are under consideration for official listing as endangered or threatened species, that are on a nonofficial State list, or that are recognized by the Regional Forester as needing special management to prevent placement on Federal or State lists.

Sensitivity Level

An inventory that measures peoples' concern for the scenic quality of the National Forests. In 1980, the Tongass National Forest assigned sensitivity levels to land areas viewed from boat anchorages, plane and boat routes, roads, trails, public-use areas, and recreation cabins.

Level I

Includes all seen areas from primary travel routes, use areas, and water bodies where at least three-fourths of the Forest visitors have a major concern for scenic quality.

Level II

Includes all seen areas from primary travel routes, use areas, and water bodies where at least one-fourth of the Forest visitors have a major concern for scenic quality.

Level III

Includes all seen areas from secondary travel routes, use areas, and water bodies where less than one-fourth of the Forest visitors have a major concern for scenic quality.

4 Lists

Seral

Early stage of succession.

Shelterwood Cutting

A harvest method in which most of the trees are removed in an initial entry and some trees are left to provide protection (from the elements) for new seedlings. A second entry removes the remaining trees.

Silviculture

The science of controlling the establishment, composition, and growth of forests.

Single-Tree Selection

A cutting method to develop and maintain uneven-aged stands by removal of selected trees from specified age classes over the entire stand area in order to meet a predetermined goal of age distribution and species in the remaining stand.

Site Index

A measure of the relative productive capacity of an area for growing wood. In the Ketchikan Area measurement of site index is based on the height of Sitka spruce trees in a stand at a given age.

Site Preparation

Manipulation of the vegetation or soil of an area prior to planting or seeding. The manipulation follows harvest, wildfire, or construction in order to encourage the growth of favored species. Site preparation may include the application of herbicides, burning, or cutting of living vegetation that competes with the favored species; tilling the soil; or burning of organic debris (usually logging slash) that makes planting or seeding difficult.

Site Productivity

Production capability of specific areas of land.

Slope Distance

Distance measured along the contour of the ground.

Smolt

Young silvery-colored salmon or trout which move from freshwater streams to saltwater.

Snag

A standing dead tree, usually greater than 5-feet tall and 6 inches in diameter at breast height.

Soil Productivity

The capacity of a soil, in its normal environment, to produce a specific plant or sequence of plants under a specific system of management.

Soil-Quality Standards

Standards that are a combination of (1) "threshold" values for severity of soil alteration, or significant change in soil condition, and (2) areal extent of disturbance.

Split Yarding

Timber harvest yarding into opposite directions.

Stand (Tree Stand)

Group of trees occupying a specific area and sufficiently uniform in composition, age, and condition as to be distinguishable from the forest in adjoining areas.

Standard

A course of action or level of attainment required by the TLMP to promote achievement of goals and objectives.

State Historic Preservation Officer (SHPO)

State-appointed official who administers Federal and State programs for cultural resources.

State Selection

Application by Alaska Department of Natural Resources to the USDI Bureau of Land Management for conveyance of a portion of the 400,000 acre State entitlement from vacant and unappropriated National Forest System lands in Alaska, under the Alaska Statehood Act of 1959 (Public Law 85-508, 72 Stat. 340).

Stocking

The volume of trees which occupy a stand as measured by basal area or number of trees, and as compared to a stocking standard; that is, the basal area or number of trees required to fully use the growth potential of the land.

Stream Classes

A means to categorize stream channels based on their fish production values. There are four stream classes on the Tongass National Forest. They are:

Class I

Streams with anadromous or adfluvial fish habitat; or high-quality resident fish waters listed in Appendix 68.1, Region 10 Aquatic Habitat Management Handbook (FSH 2609.24), June 1986; or habitat above fish migration barriers known to provide reasonable enhancement opportunities for anadromous fish.

Class II

Streams with resident fish populations and generally steep (6 to 15 percent) gradient (can also include streams from 0 to 6 percent gradient) where no anadromous fish occur, and otherwise not meeting Class I criteria. These populations have limited fisheries values and generally occur upstream of migration barriers.

Class III

Perennial and intermittent streams with no fish populations, but which have sufficient flow or transport sufficient sediment and debris to have an immediate influence on downstream water quality or fish habitat capability. These streams generally have bankfull widths greater than 5 feet and are highly incised into the surrounding hillslope.

Class IV

Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to have an immediate influence on downstream water quality or fish-habitat capability. These streams generally are shallowly incised into the surrounding hillslope.

Nonstreams

Rills and other watercourses, generally intermittent and less than 1 foot in bankfull width, with little or no incisement into the surrounding hillslope, and with little or no evidence of scour.

Stream Order

First-order streams are the smallest unbranched tributaries; second-order streams are initiated by the point where 2 first-order streams meet; third-order streams are initiated by the point where 2 second-order streams meet, and so on.

Structural Diversity

The diversity of forest structure, both vertical and horizontal, which provides for a variety of forest habitats such as logs and multi-layered forest canopy for plants and animals.

Stumpage

The value of timber as it stands uncut, in terms of dollar value per thousand board feet.

Subsistence

Section 803 of the Alaska National Interest Lands Conservation Act defines subsistence as, "the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade."

4 Lists

Subsistence-Use Area

Important subsistence-use areas include the "most reliable" and "most often hunted" categories from the Tongass Resource Use Cooperative Survey (TRUCS) and from subsistence survey data from the Alaska Department of Fish and Game, the University of Alaska, and the Forest Service, Region 10. Important use areas include both intensive and extensive use areas for subsistence harvest of deer, furbearers, and salmon.

Substrate

The type of material in the bed (bottom) of rivers and streams.

Succession

The ecological progression of community change over time, characterized by displacements of species leading towards a stable climax community.

Suitable

Commercial forest land identified as having both the biological capability and availability to produce industrial wood products.

Suitable Forest land

Forest land for which technology is available that will ensure timber production without irreversible resource damage to soils, productivity, or watershed conditions. There is reasonable assurance that such lands can be adequately restocked. There is management direction which indicates timber production is an appropriate use of that area.

Suspended Sediment

The very fine soil particles which remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.

Swale

A slight, marshy depression in generally level land. A depression in glacial ground moraine.

Tentatively Suitable Forest Land

Forest land that is producing or is capable of producing crops of industrial wood and: (a) has not been withdrawn by Congress, the Secretary of Agriculture or the Chief of the Forest Service, (b) existing technology and knowledge is available to ensure timber production without irreversible damage to soils productivity, or watershed conditions, (c) existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that it is possible to restock adequately within 5 years after final harvest, and (d) adequate information is available to project responses to timber management activities.

Terrestrial Ecosystems

Plant communities that are not dependent on a perpetual source of water to grow.

Thinning

The practice of removing some of the trees in a stand so that the remaining trees will grow faster due to reduced competition for nutrients, water, and sunlight. Thinning may also be done to change the characteristics of a stand for wildlife or other purposes. Thinning may be done in several different stages.

Threatened Species

Plant or animal species which are likely to become endangered throughout all or a significant portion of its range within the foreseeable future, as defined in the Endangered Species Act of 1973, and which has been designated in the Federal Register by the Secretary of the Interior as a threatened species. (See also, endangered species, sensitive species.)

Threshold

The point or level of activity beyond which an undesirable set of responses begins to take place within a given resource system.

Tiering

Eliminating repetitive discussions of the same issue by incorporating by reference. The general discussion in an environmental impact statement of broader scope, e.g. this document is tiered to the Tongass Land Management Plan.

Timber Appraisal

Establishing the fair market value of timber by taking the selling value minus manufacturing costs, the cost of getting logs from the stump to the manufacturer, and an allowance for profit and risk.

Timber Classification

Forested land is classified under each of the land-management alternatives according to how it relates to be management of the timber resource. The following are definitions of timber classifications used for this purpose.

Nonforest

Land that has never supported forests and land formerly forested where use for timber production is precluded by development or other uses.

Forest

Land at least 10 percent stocked (based on crown cover) by forest trees of any size, or formerly having had such tree cover and not currently developed for nonforest use.

Suitable

Land to be managed for timber production on a regulated basis.

Unsuitable

Forest land withdrawn from timber utilization by statute or administrative regulation (for example, wilderness), or identified as inappropriate for timber production in the Forest planning process.

Commercial forest

Forest land tentatively suitable for the production of continuous crops of timber and that has not been withdrawn.

Timber Dispersion

When an opening created from a final timber harvest is no longer considered an opening for the purpose of scheduling adjacent timber harvest.

Timber-Harvest Unit

A timber-harvest unit is a portion of a timber sale within which the Forest Service specifies for harvest all or part of the timber.

Timber Stand Improvement (TSI)

All noncommercial, intermediate cutting and other treatments to improve composition, condition, and volume growth of a timber stand.

Tongass Land Management Plan (TLMP)

The 10-year land allocation plan for the Tongass National Forest that directs and coordinates planning, the daily uses, and the activities carried out within the Forest.

Tongass Plan Implementation Team (TPIT)

A team created to assure consistent application of Forest Plan Standards and Guidelines across the Areas and Districts of the Tongass Forest, while continuing the involvement of partner Federal and State agencies that assisted originally in the development of the Forest Plan Standards and Guidelines.

Tongass Resource Use Cooperative Survey (TRUCS)

A study on subsistence uses which was used for evaluating the effects of the proposed action in this EIS.

TTRA

Tongass Timber Reform Act of 1990.

Turbidity

An indicator of the amount of sediment suspended in water.

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Understory

The trees and shrubs in a forest growing under the canopy or overstory.

Uneven-Aged Management

Forest management techniques which simultaneously maintain continuous high-forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes.

Unscheduled Lands

Lands suitable but not scheduled for timber production and which are not in the land base for the calculation of the allowable sale quantity nor long-term sustained-yield timber capacity.

Unsuitable

Forest land withdrawn from timber utilization by statute or administrative regulation; for example, wilderness, or identified as not appropriate for timber production in the forest planning process.

Utility Logs

Those logs that do not meet sawlog grade but are suitable for production of firm useable pulp chips.

Value Comparison Unit (VCU)

Areas which generally encompass a drainage basin containing one or more large stream systems; boundaries usually follow easily recognizable watershed divides. Established to provide a set area where resource inventories could be conducted and resource interpretations made.

Viable Population

The number of individuals of a species required to ensure the long-term existence of the species in natural, self-sustaining populations adequately distributed throughout their region.

Viewshed

An expansive landscape or panoramic vista seen from a road, marine water way, or specific viewpoint.

Visual Absorption Capability (VAC)

The capability (rated high, moderate, or low) of the landscape to visually absorb management activities. The ratings reflect the degree of landscape variety in an area, viewing distance, and topographic characteristics. As an example, steep, evenly sloped landscapes viewed in the foreground to middleground are typically given a low VAC rating.

Visual Quality Objectives (VQO)

Measurable standards reflecting five different degrees of landscape alteration based upon a landscape's diversity of natural features and the public's concern for high scenic quality. The five categories of VQOs are:

Preservation

Permits ecological changes only. Applies to wilderness areas and other special classified areas. Management activities are generally not allowed in this setting.

Retention

Provides for management activities that are not visually evident to the casual Forest visitor.

Partial Retention

Management activities remain visually subordinate to the natural landscape.

Modification

Management activities may visually dominate the characteristics landscape. Activities must borrow from naturally established form-line, color, and texture, so that the visual characteristics resemble natural occurrences within the surrounding area when viewed in the middleground distance.

Maximum Modification

Management activities may dominate the landscape but should appear as a natural occurrence when viewed as background.

V-Notch

A shallow to deeply cut stream drainage, generally in steep, mountainous terrain; would look like a "V" from a cross-section. These abrupt changes in terrain features are often used as harvest unit or yarding boundaries.

Volume

Stand volume based on standing net board feet per acre by Scribner Rule.

Volume Strata (i.e. Class)

Divisions of old-growth timber volume derived from the interpreted timber-type data layer (TIMTYP) and the common land unit data layer (CLU). Three volume strata (low, medium, and high) are recognized in the 1997 TLMP for each administrative Area. For the Ketchikan Area, the average thousand board feet per acre for the three strata are as follows:

Low: 13.9 MBF

Medium: 23.3 MBF

High: 29.9 MBF

Watershed

The area that contributes water to a drainage or stream. Portion of the forest in which all surface water drains to a common point. Watersheds can range from tens of acres that drain to a single small intermittent stream to many thousands of acres that drain hundreds of connected intermittent and perennial streams.

Wetland

Areas that are inundated by surface or groundwater frequently enough to support vegetation that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include: swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mudflats, and natural ponds. See the TLMP 1997 pg. 4-111 for detailed discussion on wetland type definitions.

Wilderness

Areas designated by congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped Federal land retaining its primeval character and influence without permanent improvements or humans habitation. Wilderness areas are:

- protected and managed to preserve their natural conditions, which are affected primarily by the forces of nature, with the imprint of human activity substantially unnoticeable,
- have outstanding opportunities for solitude or a primitive and unconfined type of recreation,
- areas of at least 5,000 acres are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition, and
- may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest.

In Alaska, Wilderness has been designated by the ANILCA and the TTRA.

Wildlife Analysis Area (WAA)

Land delineated by the Alaska Department of Fish and Game for wildlife analysis.

Wildlife Habitat

The locality where a species may be found and where the essentials for its development and sustained existence are obtained.

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Windfirm

Trees that have been exposed to the wind throughout their life and have developed a strong root system or trees that are protected from the wind by terrain features.

Windthrow

The act of trees being uprooted by the wind. In Southeast Alaska, Sitka spruce and hemlock trees are shallow rooted and susceptible to windthrow. There generally are three types of windthrow:

Endemic

Individual trees are blown over.

Catastrophic

A major windstorm can destroy hundreds of acres.

Management Related

The clearing of trees in an area make the adjacent standing trees vulnerable to windthrow.

Winter Range

An area, usually at lower elevation, used by big game during the winter months; usually smaller and better-defined than summer ranges.

Withdrawal

The withholding of an area of Federal land from settlement, sale, location, or entry under some or all of the general land laws for the purpose of limiting activities under those laws in order to maintain other public values in the area.

Yarding

Hauling timber from the stump to a collection point.

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